The NATIONAL NC 109 COMMUNICATIONS RECEIVER

EST. 1914

NATIONAL COMPANY INC., MALDEN, MASSACHUSETTS

STANDARD FORM WARRANTY

ADOPTED BY THE RADIO MANUFACTURERS ASSOCIATION, INC.

This equipment is warranted to be free from defective material and workmanship and repair or replacement will be made of any part which under normal installation, use and service discloses defect, provided the unit is delivered by the owner to the manufacturer or through the authorized radio dealer or wholesaler from whom purchased, intact, for examination, with all transportation charges prepaid to the factory, within ninety days from the date of sale to original purchaser, and provided that such examination, discloses in the manufacturer's judgement that it is thus defective.

This warranty does not extend to any radio products which have been subjected to misuse, neglect, accident, incorrect wiring, improper installation, or to use in violation of instructions furnished by the manufacturer, nor extend to units which have been repaired or altered outside of the factory, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith of other manufacture.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for the manufacturer any other liability in connection with the sale of their radio products.

National Company, Inc. reserves the right to make any change in design or to make addition to, or improvements in, its products without imposing any obligations upon itself to install them in its products previously manufactured.

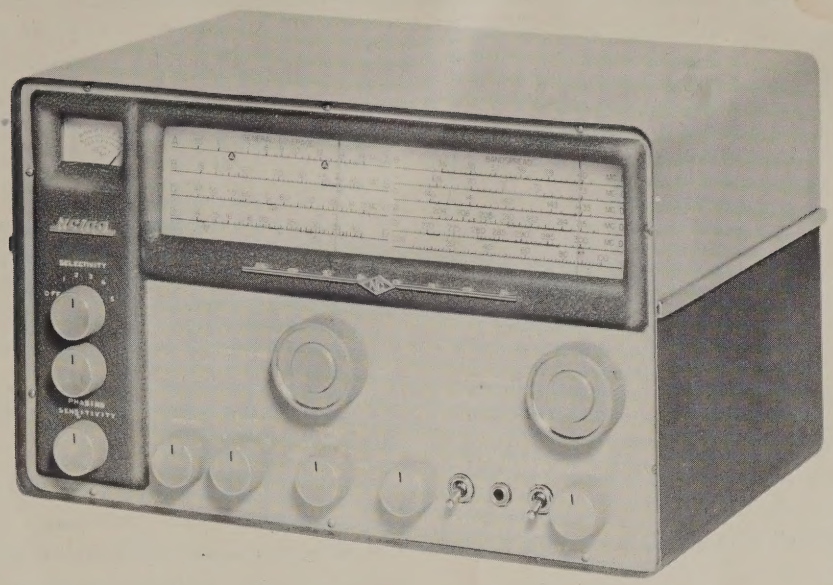


Figure 1-1. The National NC109 Receiver

SECTION 1 DESCRIPTION

1.1 GENERAL

Present day operating requirements of amateur radio operators and short-wave listeners are completely fulfilled by your new National NC109. All of the most desirable features for communications applications are incorporated in this fine receiver. Accurate bandspread tuning, single sideband reception, crystal filter with six degrees of selectivity, S-meter, and accommodations for a crystal calibrator, narrow band FM adaptor, or other accessories are provided.

The frequency range of your NC109, 0.54 to 40.0 mc, covers the amateur, commercial, foreign broadcasts, marine, standard broadcast, and civil defense bands. This frequency range is divided into four tuning bands which are selected by the BAND switch. Frequency ranges of these four bands are as follows:

BAND	FREQUENCY RANGE
A	0.54 mc to 1.6 mc
B	1.6 mc to 4.7 mc
C	4.6 mc to 15.0 mc
D	14.0 mc to 40.0 mc

Bandspread tuning is provided to take full advantage of your receiver's high degree of selectivity. The bandspread dial has calibrated scales for each major amateur band and a logging scale for the various short-wave bands. Adjustable selectivity characteristics of the crystal filter make it possible to reject interfering signals on crowded bands and reduce objectionable heterodynes caused by undesired signals.

Indications of relative signal strength and tuning accuracy are obtained from the S-meter. Meter calibration is in "S" units from 0 to 9 and in decibels from 0 to 40 db above S9.

1.2 CIRCUIT DESCRIPTION

Eleven vacuum tubes, including a rectifier and a voltage regulator, are used. These tubes, their functions and schematic diagram reference symbols are listed in Table I.

TABLE I

REF. SYM.	TUBE TYPE	FUNCTION	REF. SYM.	TUBE TYPE	FUNCTION
V1	6BA6	RF Amplifier	V6	6BE6	CW Oscillator and SSB Demodulator
V2	6BE6	Mixer			
V3	6BA6	1st IF Amplifier	V7	6C4	HF Oscillator
V4	6BA6	2nd IF Amplifier	V8	5Y3GT	Rectifier
V5A	½ 6AL5	Detector and AGC	V9	0B2	Voltage Regulator
V5B	½ 6AL5	Noise Limiter	V10A	½ 12AT7	S-meter Amplifier
			V10B	½ 12AT7	Audio Amplifier
			V11	6AQ5	Audio Output Amplifier

A superheterodyne circuit is used in which signals from the RF amplifier and local oscillator are heterodyned in the mixer producing a 455 kc IF signal. This mixer product is then amplified by two stages of IF amplification and demodulated in the detector. The resulting intelligence is amplified by two audio amplifier stages to a sufficiently high level to drive a loudspeaker or headphones.

The crystal filter provides six degrees of selectivity as shown in the IF selectivity chart, figure 3-3. Bandwidth of the crystal filter varies from 3.8 kc to 50 cycles at 6 db points over the six positions of the SELECTIVITY switch.

A product detector is used for single sideband and CW reception. An extremely stable CW oscillator is used for carrier injection. Sufficient oscillator stability for single sideband reception is ensured by power supply regulation and careful circuit design.

CAUTION

YOUR NC109 IS DESIGNED TO OPERATE FROM A 105 TO 130 VOLT 50 TO 60 CYCLE AC SOURCE ONLY. CONNECTION TO A DC POWER SOURCE WILL RESULT IN SERIOUS DAMAGE.

SECTION 2 INSTALLATION

2.0 UNPACKING

To prevent damaging your receiver when unpacking, the procedure outlined below should be followed:

a. Remove top pad and cover insert.
b. Remove rear insert.
c. Slide receiver back in the carton.
d. Remove front insert.
e. Your receiver will now be free of packing material and may be taken from its carton.

2.1 INITIAL SETUP

Your NC109 has been carefully inspected and tested before shipment and is ready to put into operation. Location of your NC109 should be such that the rear of the receiver is at least two inches from any obstruction to allow adequate ventilation.

Terminal strips, for connection of a loud-speaker and antenna, are provided as illustrated in figure 2-1. Receiver output is designed to match a 3.2 ohm loudspeaker. A National NTS-1 matching speaker is recommended for use with your NC109.

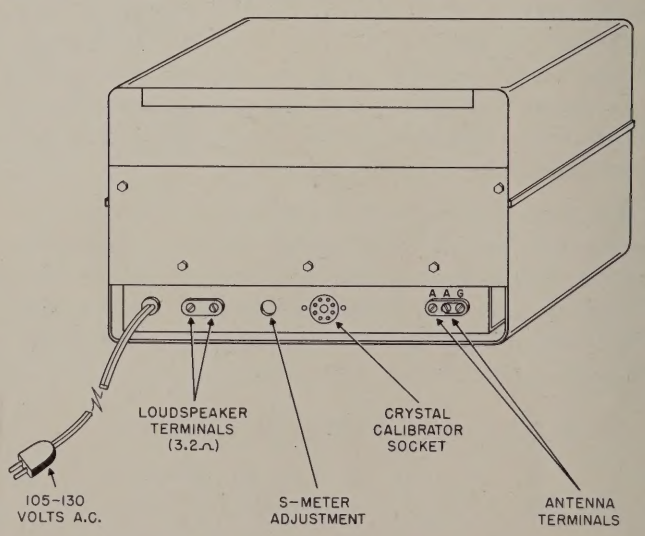


Figure 2-1. Rear View of NC109 Receiver

A single wire antenna, similar to that illustrated in figure 2-2, may be used quite successfully for general communications reception. In cases where an antenna is desired for better operation in a limited frequency range, a doublet antenna, similar to that illustrated in figure 2-3, is recommended. The lightning arrestors and water pipe ground connections shown in the antenna illustrations are optional.

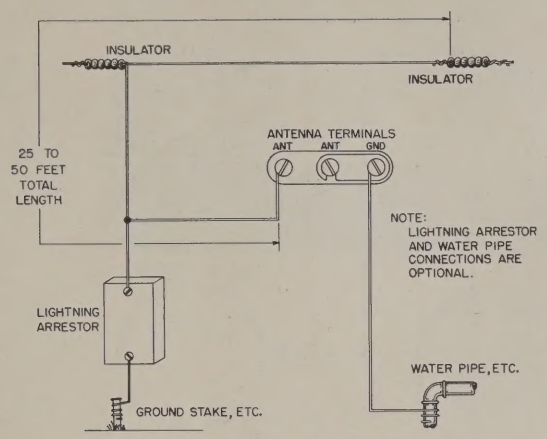


Figure 2-2. Typical Single-Wire Antenna Hookup

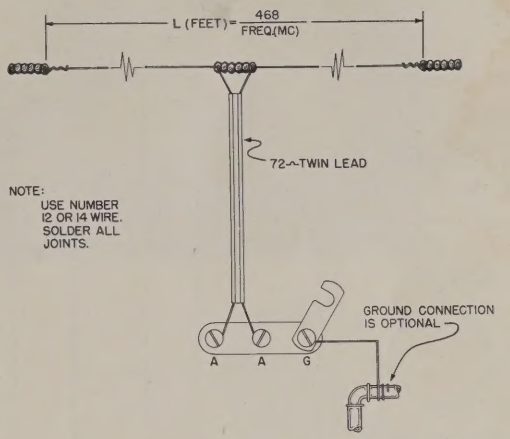


Figure 2-3. Typical Doublet Antenna Hookup

SECTION 3 OPERATION

3.0 CONTROLS

All controls and indicators necessary to operate your NC109 are located on the front panel. The diagram on the following page, (figure 3-1), shows the location of these controls, switches, and indicators and gives a functional description of each part.

3.1 OPERATING PROCEDURES

Initial control and switch settings are shown in Table II.

TABLE II

CONTROL	AM SETTING	SSB SETTING	CW SETTING
SELECTIVITY	OFF	OFF	OFF
PHASING	(par. 3.5)	(par. 3.5)	(par. 3.5)
SENSITIVITY	Maximum	Mid position	Mid position
ANTENNA	Mid position	Mid position	Mid position
BAND	Optional	Optional	Optional
MODE	AM	SSB	CW
PITCH	Inoperative	Mid position	Mid position
REC-STBY	REC	REC	REC
TONE	Optional	Optional	LO
VOLUME	Mid position	Maximum	Maximum
MAIN TUNING	Optional	Optional	Optional
BANDSPREAD	SET	SET	SET

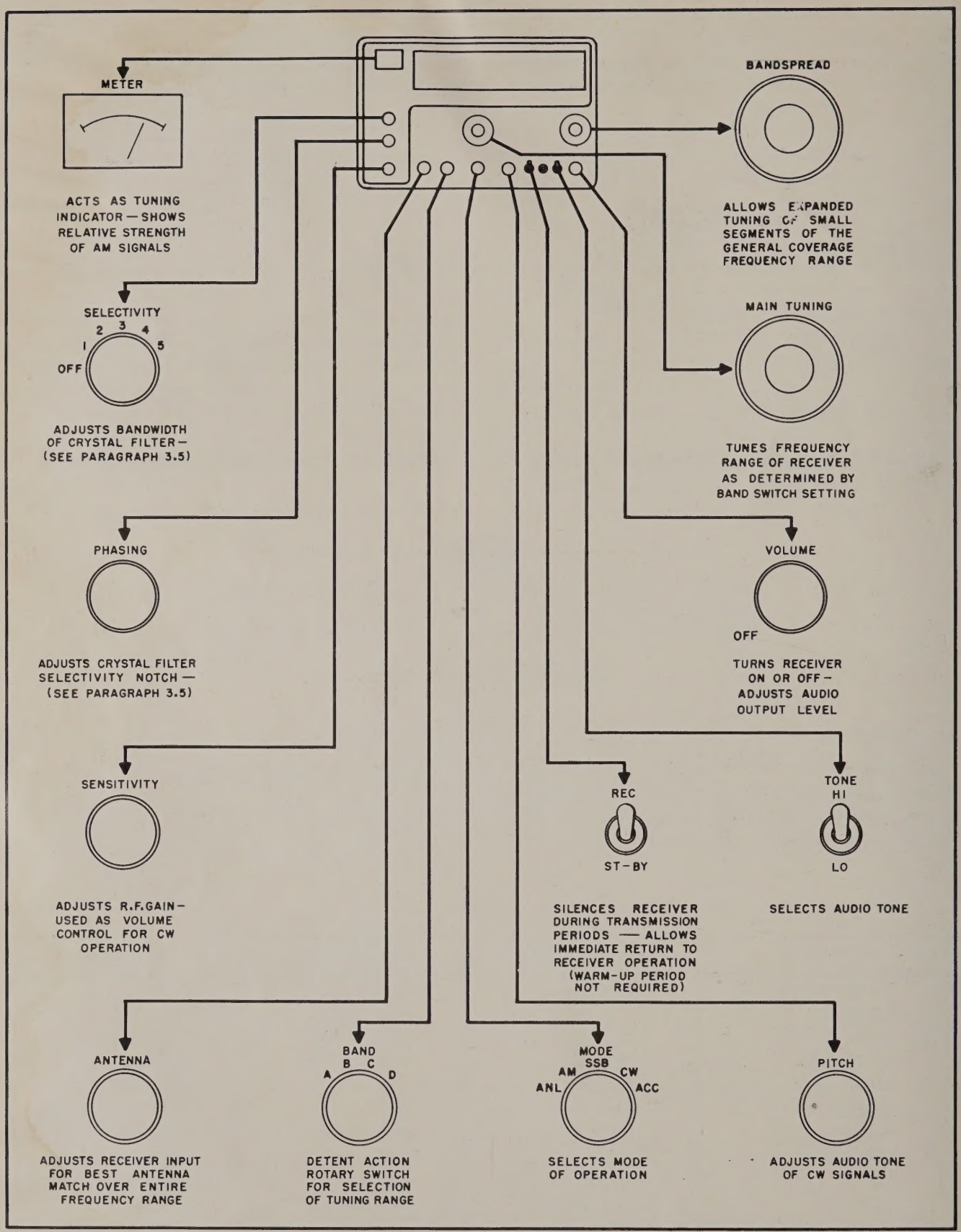

METER
ACTS AS TUNING INDICATOR — SHOWS RELATIVE STRENGTH OF AM SIGNALS
BANDSPREAD
ALLOWS EXPANDED TUNING OF SMALL SEGMENTS OF THE GENERAL COVERAGE FREQUENCY RANGE
SELECTIVITY
OFF 1 2 3 4 5
ADJUSTS BANDWIDTH OF CRYSTAL FILTER — (SEE PARAGRAPH 3.5)
MAIN TUNING
TUNES FREQUENCY RANGE OF RECEIVER AS DETERMINED BY BAND SWITCH SETTING
PHASING
ADJUSTS CRYSTAL FILTER SELECTIVITY NOTCH — (SEE PARAGRAPH 3.5)
VOLUME
OFF
TURNS RECEIVER ON OR OFF — ADJUSTS AUDIO OUTPUT LEVEL
SENSITIVITY
ADJUSTS R.F. GAIN — USED AS VOLUME CONTROL FOR CW OPERATION
REC
ST-BY
SILENCES RECEIVER DURING TRANSMISSION PERIODS — ALLOWS IMMEDIATE RETURN TO RECEIVER OPERATION (WARM-UP PERIOD NOT REQUIRED)
TONE
HI
LO
SELECTS AUDIO TONE
ANTENNA
ADJUSTS RECEIVER INPUT FOR BEST ANTENNA MATCH OVER ENTIRE FREQUENCY RANGE
BAND
A B C D
DETENT ACTION ROTARY SWITCH FOR SELECTION OF TUNING RANGE
MODE
SSB AM CW ANL ACC
SELECTS MODE OF OPERATION
PITCH
ADJUSTS AUDIO TONE OF CW SIGNALS

Figure 3-1. Location and Function of Controls

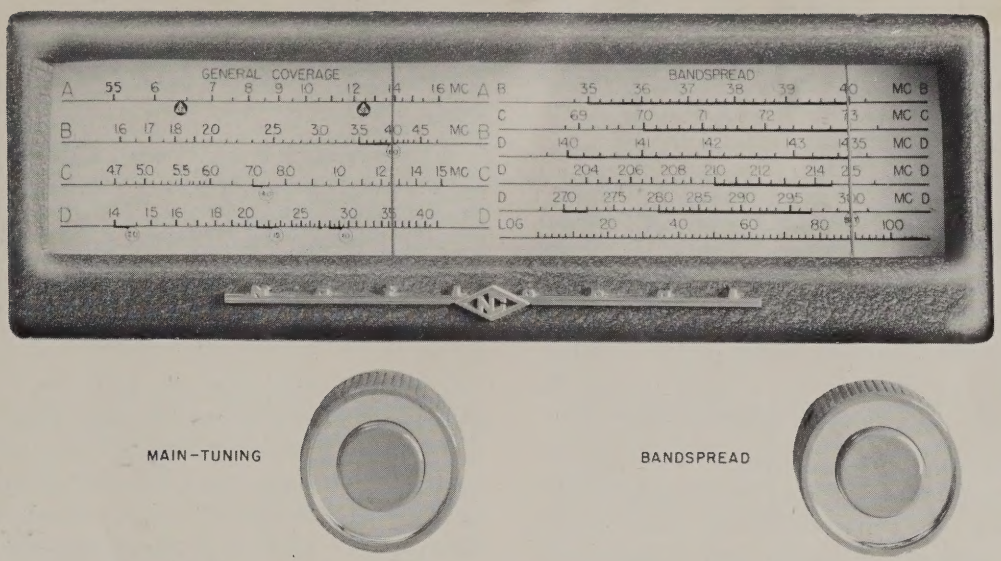


Figure 3-2. NC109 Dial Scales and Tuning Controls

3.1.1 AM Operation

The following adjustments will be necessary during operation:

a. Select frequency range by positioning BAND switch.

b. Set the GENERAL COVERAGE dial pointer in the band to be tuned at a spot where no signal is heard and adjust the ANTENNA control for maximum background noise. This setting is satisfactory while operating over a limited frequency range.

c. Adjust the MAIN TUNING control to select a signal.

d. Adjust VOLUME for a comfortable listening level.

e. If excessive spurious noises are heard, (auto ignition, etc.), place the MODE switch in its ANL position. Automatic noise limiting reduces fidelity and therefore should be used only when necessary.

3.1.2 CW Operation

a. The SENSITIVITY control is used as a volume control for CW operation and should be adjusted accordingly.

b. Adjust the PITCH control for a pleasing note.

c. All other adjustments are the same as for AM operation.

3.1.3 Single Sideband Operation

The recent upsurge in single sideband activity by amateur radio operators makes it necessary for a communications receiver to have a beat-frequency oscillator that is sufficiently stable to produce a constant carrier injection signal, and a system of demodulation capable of reproducing single sideband intelligence without strong harmonic distortion. Both of these requirements are fulfilled by your NC109.

The procedure for tuning single sideband signals with your NC109 is relatively simple. First, set up your receiver for bandspread tuning an amateur band (as described in paragraph 3.2). Set the MODE switch at AM and the PITCH control to its center position. Adjust the BANDSPREAD control to locate a single sideband signal (identified by its "garbled" sound). Set the VOLUME control at maximum. Carefully tune for maximum S-meter deflection. Set the MODE switch to SSB and adjust the PITCH control slightly to either side of center until the "garble" clears and a readable signal is obtained. The SENSITIVITY control is used as a volume control for SSB reception.

3.2 TUNING

The GENERAL COVERAGE and BANDSPREAD scales (figure 3-2) are calibrated in megacycles and contain special markings to simplify tuning. The CONELRAD frequencies, .64 and 12.4 mc, are indicated on band A by the civil defense symbol

The major amateur radio bands are contained in bands B, C and D. Each amateur band is underlined in black on both the GENERAL COVERAGE and BANDSPREAD scales. On the GENERAL COVERAGE scale the amateur bands are identified by a circle located at the high end of each band which contains the band's wavelength designator ((80) designates the 80 meter amateur band).

Calibration of the GENERAL COVERAGE scale is correct when the BANDSPREAD pointer is in its SET position. For correct calibration of the bandspread scales the GENERAL COVERAGE pointer must be set in the center of the designator circle for the band to be tuned. Figure 3-2 shows the correct pointer positions for bandspreading the 80 meter amateur band.

Short-wave bandspreading, for other than amateur bands, is accomplished by setting the BANDSPREAD pointer at SET and the GENERAL COVERAGE pointer at the high end of the short-wave band to be tuned. Adjust the bandspread control to select the desired station. Notation of the point on the LOG scale where the desired station was located will enable the operator to locate the same station in the future without difficulty.

3.3 MEASUREMENT OF SIGNAL STRENGTH

The S-meter provides a means of measuring the relative strength of incoming AM signals. Accurate measurements of relative signal strength are taken with the SENSITIVITY control set in its extreme clockwise position. These measurements are read in S units from 1 to 9 and in decibels above S9 from 0 to 40 db. The S-meter circuit is disabled under CW and SSB operating conditions.

A screwdriver control, located at the rear of receiver, is provided for zeroing the S-meter electrically. This adjustment is made on "B" band with the antenna disconnected or shorted and the SENSITIVITY control set at maximum.

3.4 SHORT-WAVE LISTENING

Bands B, C and D are the high frequency or short-wave bands. The frequency range of these bands covers short-wave foreign broadcasts, amateur, and commercial radio transmitting stations all over the world. There are literally millions of radio stations in operation today most of which transmit signals within the tuning range of your NC109.

The principal short-wave broadcast stations operate on five major and two minor bands. One characteristic of short-waves is that reception will be good on some bands at certain times of day and, at the same time, poor on other bands. Table III lists the major short-wave broadcast bands, their frequencies and their normal signal strength characteristics at different times of day.

TABLE III

BAND	17 METER	19 METER	25 METER	31 METER	49 METER
FREQUENCY RANGE	17.7-17.9 mc	15.1-15.45 mc	11.7-11.95 mc	9.6-9.8 mc	6.0-6.2 mc
SUNRISE TO NOON	Eastern stations good	Same as 17 meter	West and southwest good	Same as 25 meter	Same as 25 meter
NOON TO SUNSET	South good	East and south good	Same as 19 meter	East good	Most signals weak
SUNSET TO MIDNIGHT	Stations fade-band goes dead	Same as 17 meter	East fades south strong	Same as 25 meter	North, south and east very good

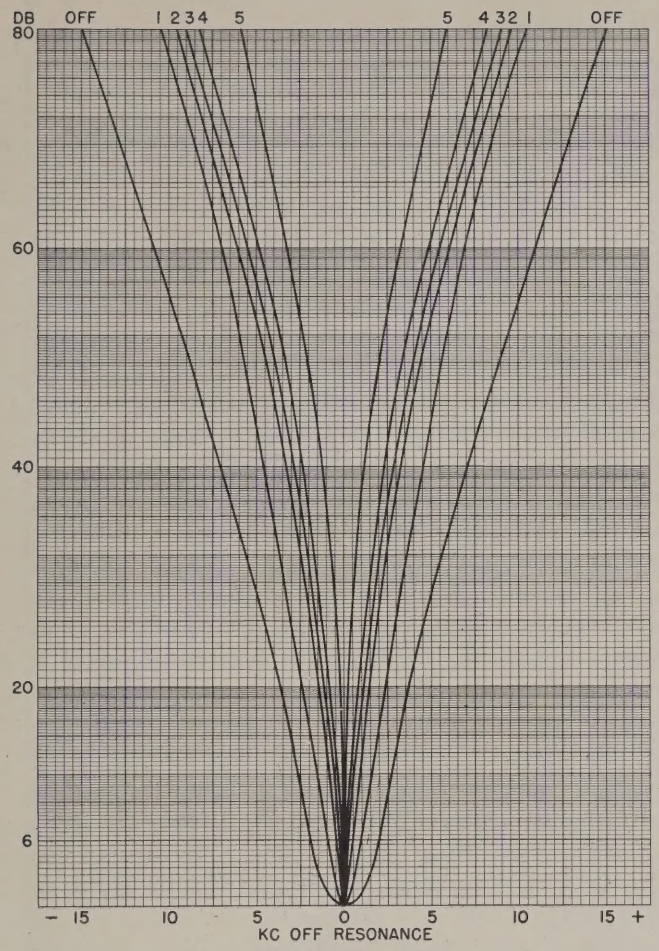


Figure 3-3. IF Selectivity Characteristics

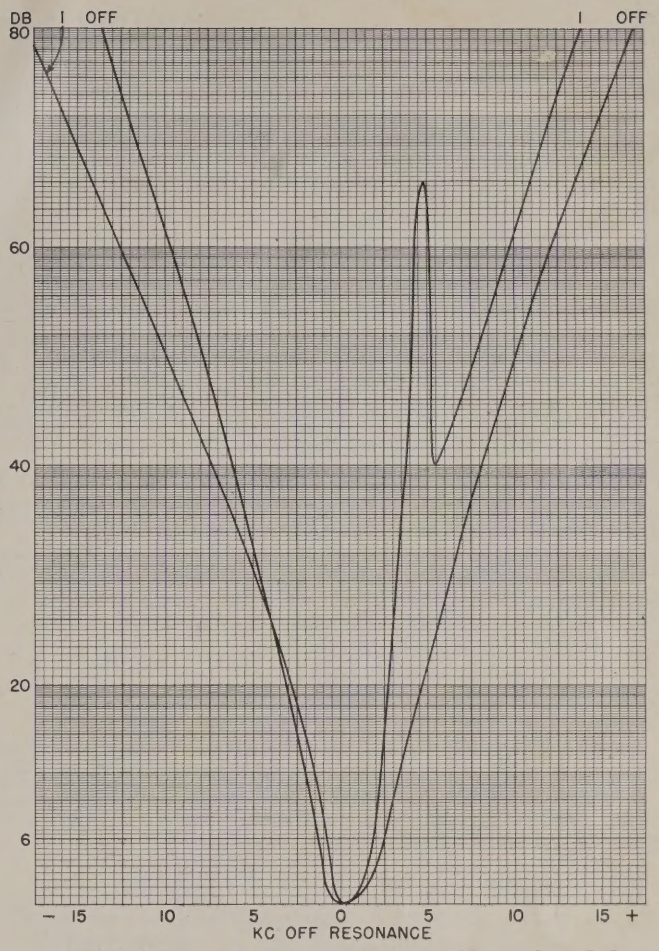


Figure 3-4. Crystal Filter Selectivity Characteristics

3.5 CRYSTAL FILTER OPERATION

A crystal filter circuit, located in the first IF amplifier stage, is used to control the selectivity of your NC109. The SELECTIVITY and PHASING controls are used to operate this filter. Bandwidths of the filter range from 3.8 kc in the OFF position to 50 cps in position 5 of the SELECTIVITY control as illustrated in figure 3-3. The PHASING control provides a means of suppressing interfering CW or MCW signals which may produce objectionable heterodynes.

Under normal AM operating conditions, the SELECTIVITY control is used in the OFF position. If interference to the desired signal is present the SELECTIVITY control may be set to position 1 or 2. Selectivity sharper than this usually causes too great a loss of fidelity to be useful for AM operation. When using the crystal filter for AM reception, the signal should be tuned to a peak on the S-meter. The PHASING control can then be used to eliminate interfering heterodynes. If the receiver is properly tuned the PHASING control will have no effect on the signal.

Any position of the SELECTIVITY control may be used for CW reception depending on the degree of selectivity required. Position 5 will give the sharpest selectivity with the greatest freedom from interference and lowest background noise level but can only be used on very stable signals. The PHASING control introduces a "notch" (see curve of figure 3-4) which may be moved through the bandwidth of the filter to eliminate interfering signals.

SECTION 4 MAINTENANCE

4.1 GENERAL

Information contained in this section will aid qualified service personnel in servicing and aligning your NC109.

4.2 REMOVING THE CHASSIS

All knobs, the rear cover and cabinet feet must be removed before the chassis can be taken out of the cabinet. All knobs are push-on type except the two large tuning knobs which are held in place by set screws. The rear cover is held on by five screws. Recessed screws in the cabinet feet hold the chassis in the cabinet.

4.3 TEST EQUIPMENT

The following test equipment is required to align your NC109.

a. AM signal generator having:
   (1) 30% modulation at 400 cps.
   (2) Frequency range from 455 kc to 30 mc.

b. Output meter.

c. Accurate frequency standard (XCU-109)

4.4 IF ALIGNMENT

IF alignment must be made at the frequency of the crystal in Z4. Connect a signal generator to the main tuning condenser mixer stator. Set the SENSITIVITY and VOLUME controls at maximum. Remove modulation from the input signal. Set the SELECTIVITY switch to 5 and input level to 200 microvolts. Tune the generator around 455 kc until a sharp peak is obtained on the S-meter. The generator is now tuned to the crystal frequency. Set the MODE switch to CW. With the dot on the PITCH control vertical, set the BFO to zero-beat by adjusting the slug in L10. Set the MODE switch to AM and modulate the input signal. Set the SELECTIVITY switch to OFF and adjust Z1, Z2 and Z3 for maximum audio output keeping the output level around 100 milliwatts by adjusting the input level. With modulation off and the generator tuned to crystal frequency, set the MODE switch to CW. Set the PHASING and PITCH controls with their dots vertical. The BFO should nearly zero-beat with the generator frequency. Set the SELECTIVITY switch to 1 and detune the generator approximately 2 kc in either direction. Adjust the slug in Z4 for maximum audio output. Check the PHASING control by adjusting it to a position where the beat note is completely eliminated. Repeat this check with the generator detuned to the other side of zero-beat. (Complete elimination of the beat note should be possible.) The two phasing positions should occur near the center of the PHASING control range. Tune the generator to the crystal frequency with modulation on. Set the MODE switch to AM, SELECTIVITY to OFF and adjust C20 in Z4 for maximum audio output. The IF section is now properly aligned.

TABLE IV RF CHART

BAND	A	B	C	D
SET GENERATOR	.6 mc	1.6 mc	5 mc	14 mc
SET MAIN TUNING	.6 mc	1.6 mc	5 mc	14 mc
ADJUST TO TUNE	L-5	L-6	L-7	L-8
SET GENERATOR			5.5 mc	16 mc
SET MAIN TUNING			To signal	To signal
ADJUST FOR MAXIMUM			Loop in L-1c Loop in L-3c	L-2 L-4
SET GENERATOR	1.5 mc	4 mc	14 mc	30 mc
SET MAIN TUNING	1.5 mc	4 mc	14 mc	30 mc
ADJUST TO TUNE	C-53	C-54	C-55	C-56
ADJUST FOR MAX.	C-8	C-9	C-10	——
SET MAIN TUNING				26 mc
ADJUST FOR MAXIMUM NOISE				C-11

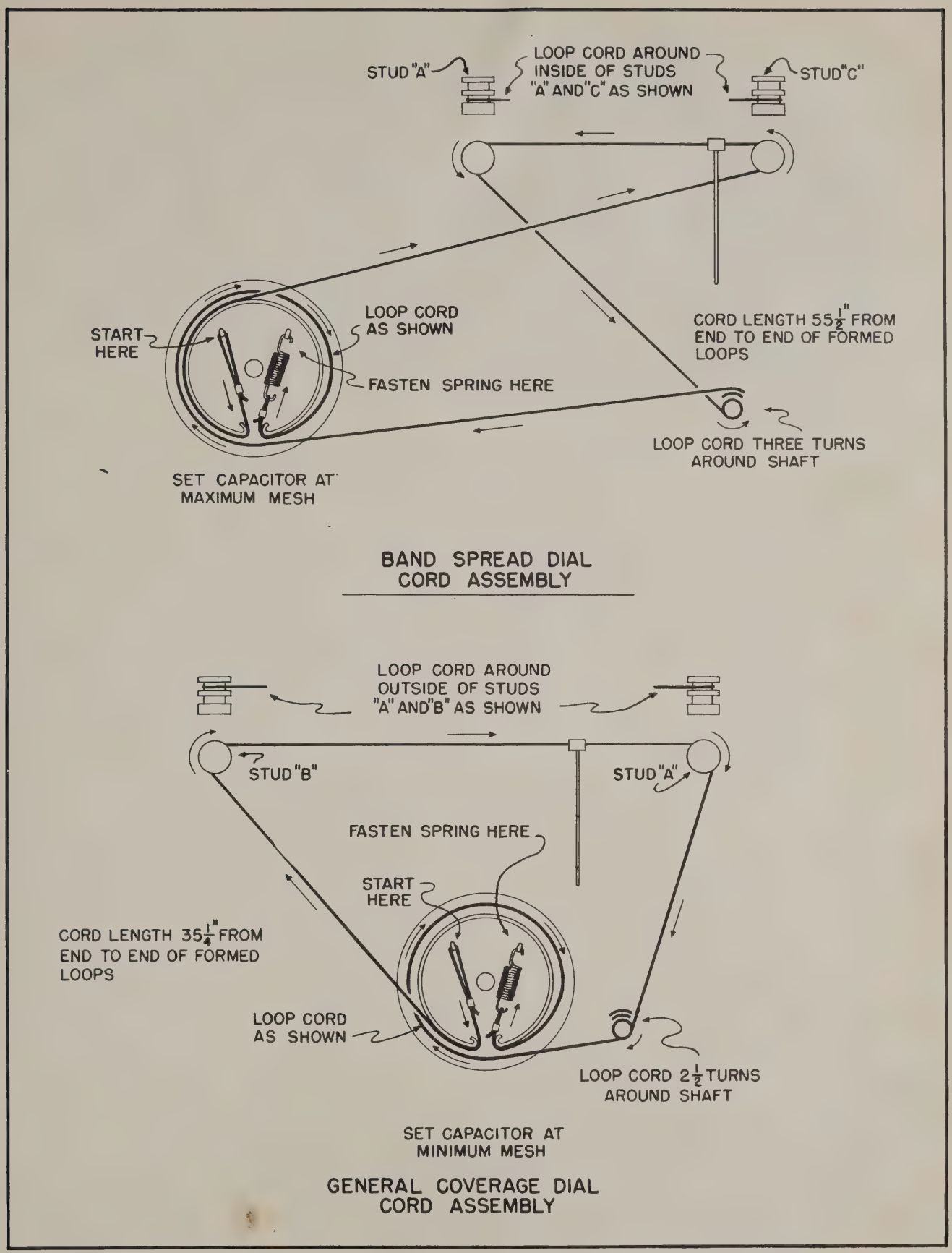

STUD "A"
LOOP CORD AROUND INSIDE OF STUDS "A" AND "C" AS SHOWN
STUD "C"
START HERE
LOOP CORD AS SHOWN
FASTEN SPRING HERE
CORD LENGTH 55 1/2" FROM END TO END OF FORMED LOOPS
LOOP CORD THREE TURNS AROUND SHAFT
SET CAPACITOR AT MAXIMUM MESH
BAND SPREAD DIAL CORD ASSEMBLY
LOOP CORD AROUND OUTSIDE OF STUDS "A" AND "B" AS SHOWN
STUD "B"
STUD "A"
FASTEN SPRING HERE
START HERE
CORD LENGTH 35 1/4" FROM END TO END OF FORMED LOOPS
LOOP CORD AS SHOWN
LOOP CORD 2 1/2 TURNS AROUND SHAFT
SET CAPACITOR AT MINIMUM MESH
GENERAL COVERAGE DIAL CORD ASSEMBLY

Figure 4-1. Dial Stringing Diagrams

Figure A-1. NC109 with NTS-1 Loud Speaker

SECTION A ACCESSORIES

A.1 NTS-1 LOUDSPEAKER

The National NTS-1 (figure A-1) is an accessory loudspeaker assembly. Style, finish and electrical properties of the NTS-1 make it a perfect match for your NC109.

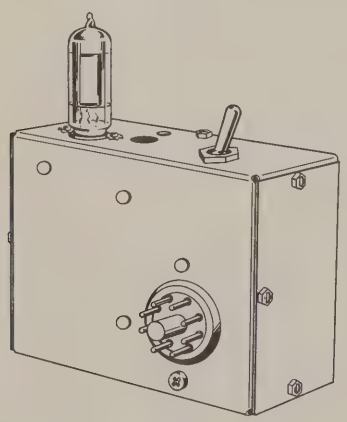


Figure A-2. XCU-109 Crystal Calibrator

A.2 XCU-109 CRYSTAL CALIBRATOR

The National XCU-109 (figure A-2) is a crystal calibrator unit specifically designed for use with the NC109 receiver. An electron-coupled crystal oscillator is used to provide marker frequencies at one megacycle intervals. The oscillator is activated by the toggle switch located on the top of the XCU-109.

A.3 NFM-83-50 ADAPTOR

Your NC109 is adaptable for narrow band FM operation when used with the NFM-83-50 adaptor. (figure A-3) Operating instructions given in paragraph 3.2 of this manual are applicable to NFM operation except that the AM position of the MODE switch is recommended when scanning for FM signals.

An FM signal is recognized by the presence of an audio null in the center of its carrier. Once an FM signal is located, set the MODE switch to its ACC position and tune for maximum response.

NOTE

The pass band of the NFM-83-50 is sufficiently wide to accommodate any narrow band FM signal if the transmitter is held within recommended deviation limits. If excessive peak deviation occurs at the transmitter, distortion will result in the receiver when the adaptor is in use even though the signal appears undistorted when using AM slope detection.

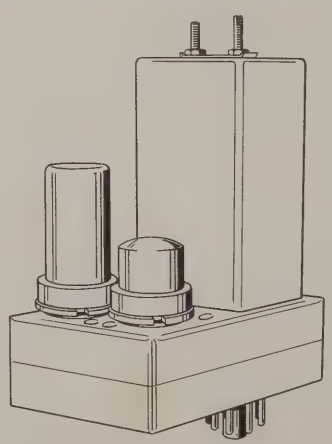
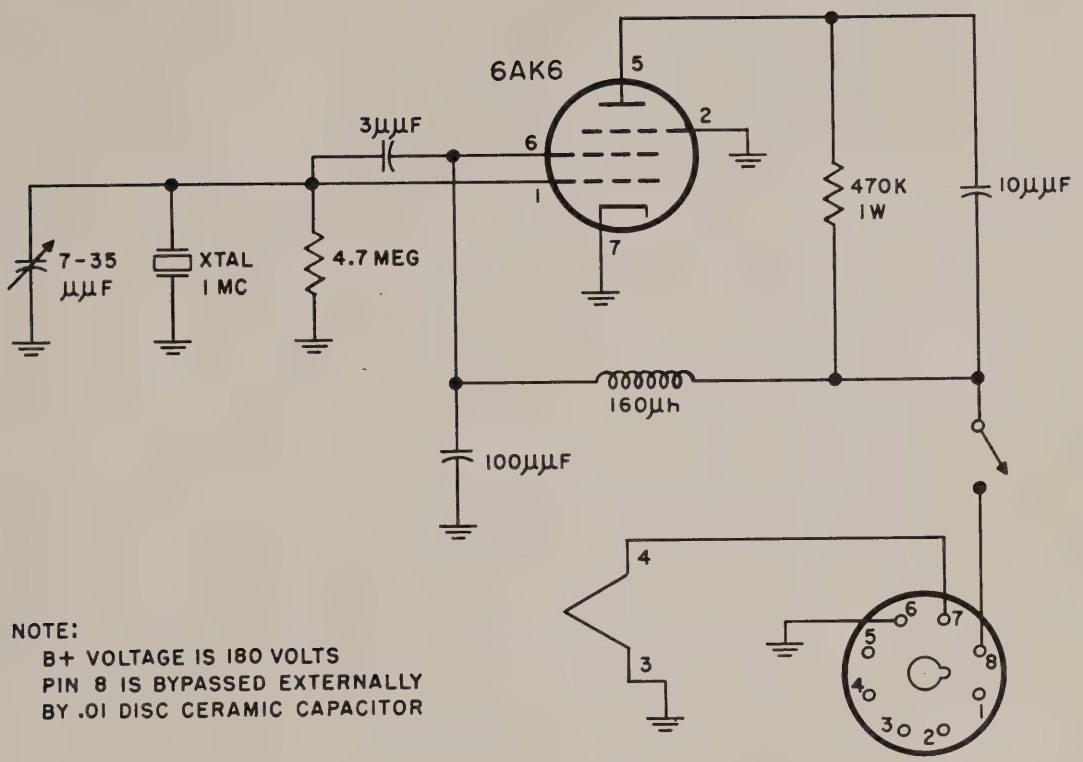


Figure A-3. NFM-83-50 Adaptor



XCU-109 Crystal Calibrator Schematic Diagram

NOTES

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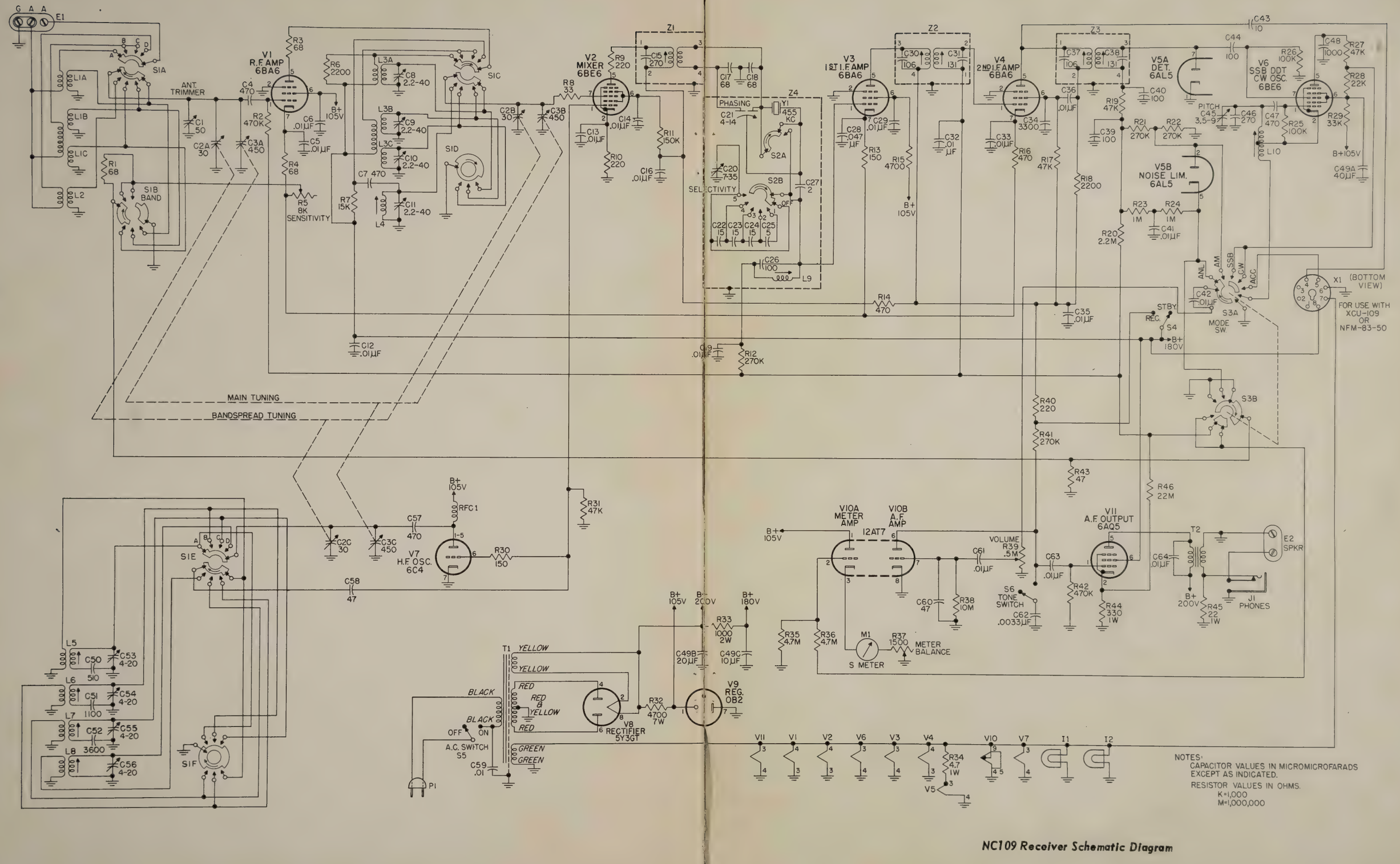
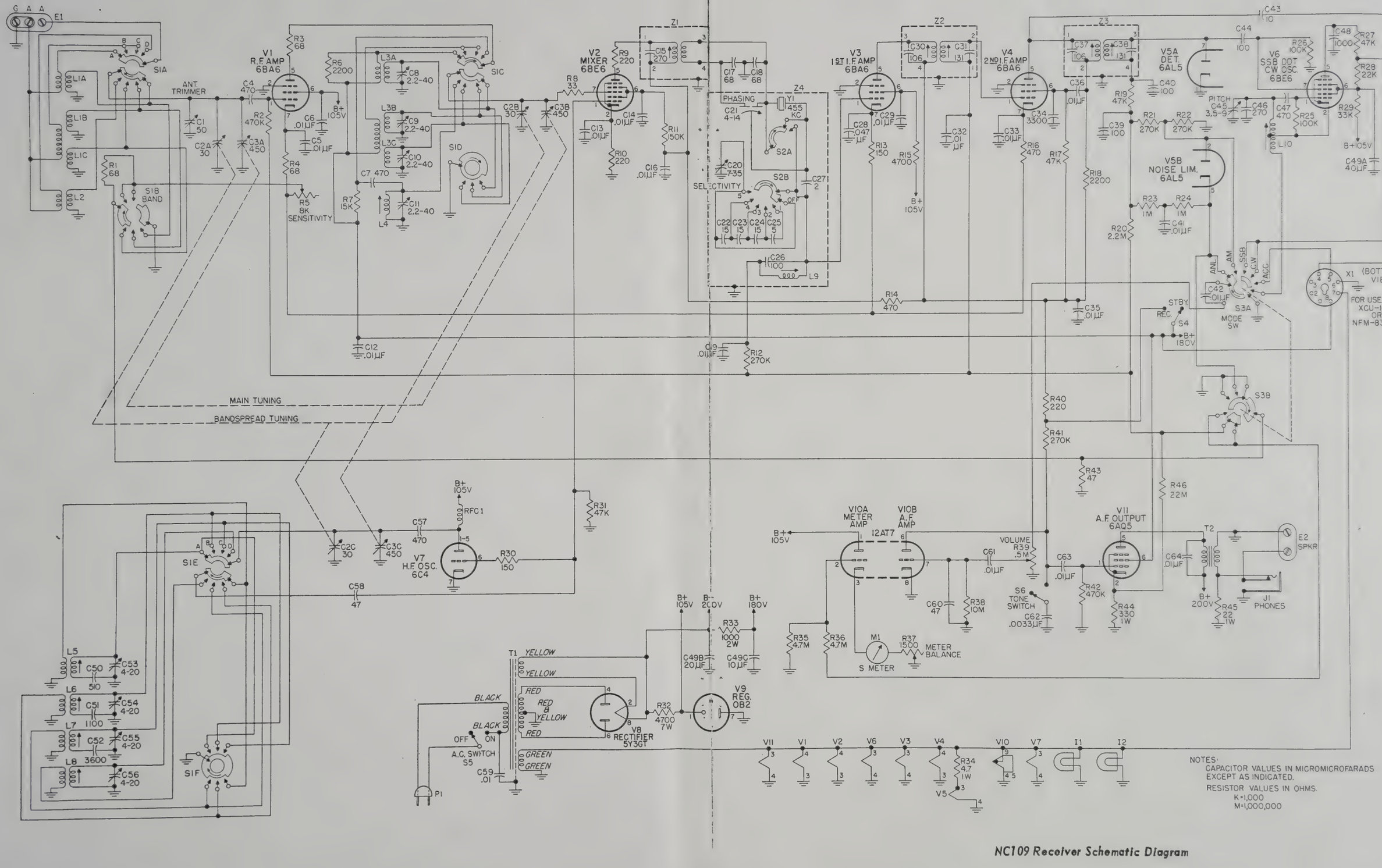


NOTES:
CAPACITOR VALUES IN MICROMICROFARADS EXCEPT AS INDICATED.
RESISTOR VALUES IN OHMS.
K=1,000
M=1,000,000

NC109 Receiver Schematic Diagram



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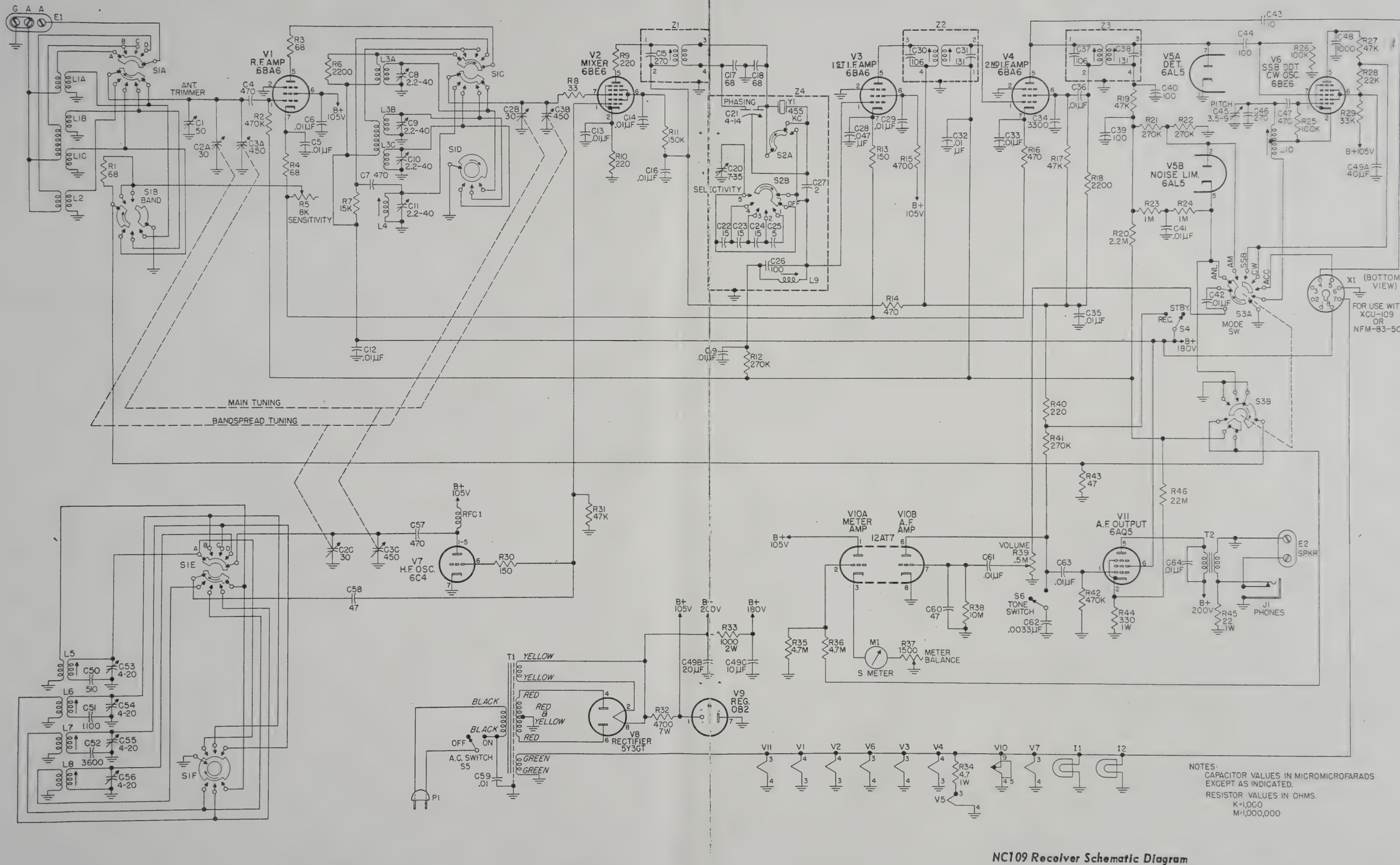
NC109 Receiver Schematic Diagram



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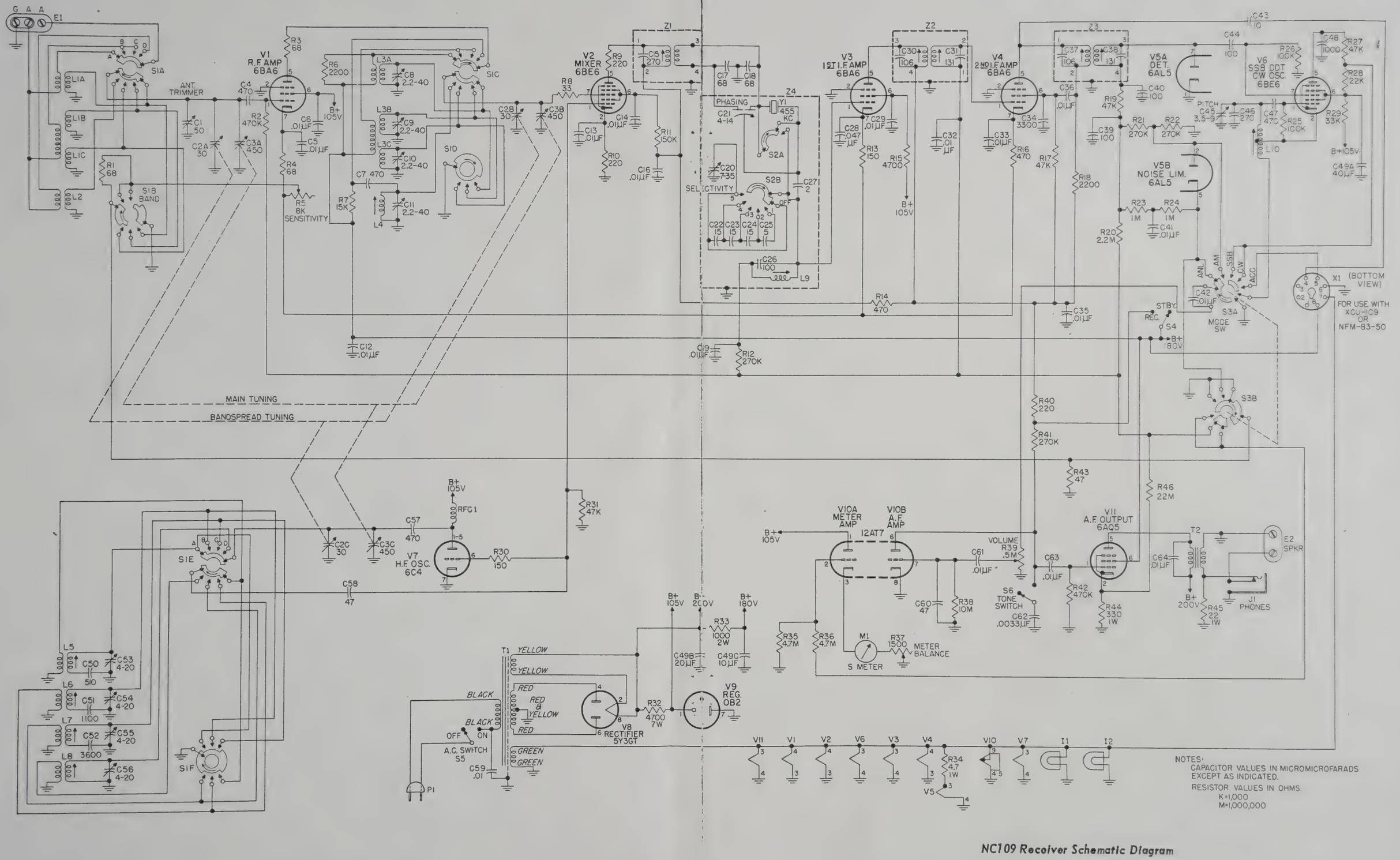
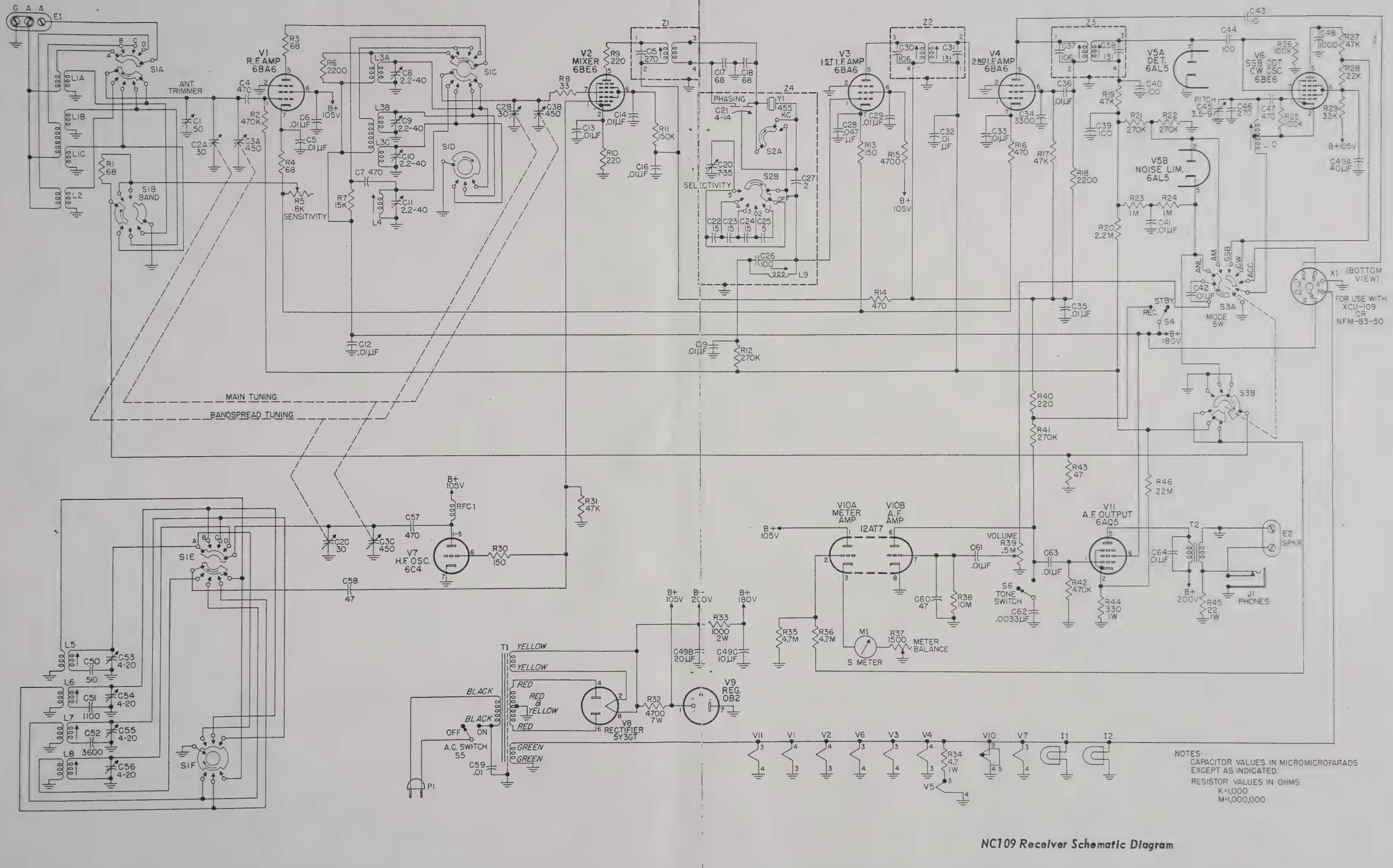


NC109 Receiver Schematic Diagram



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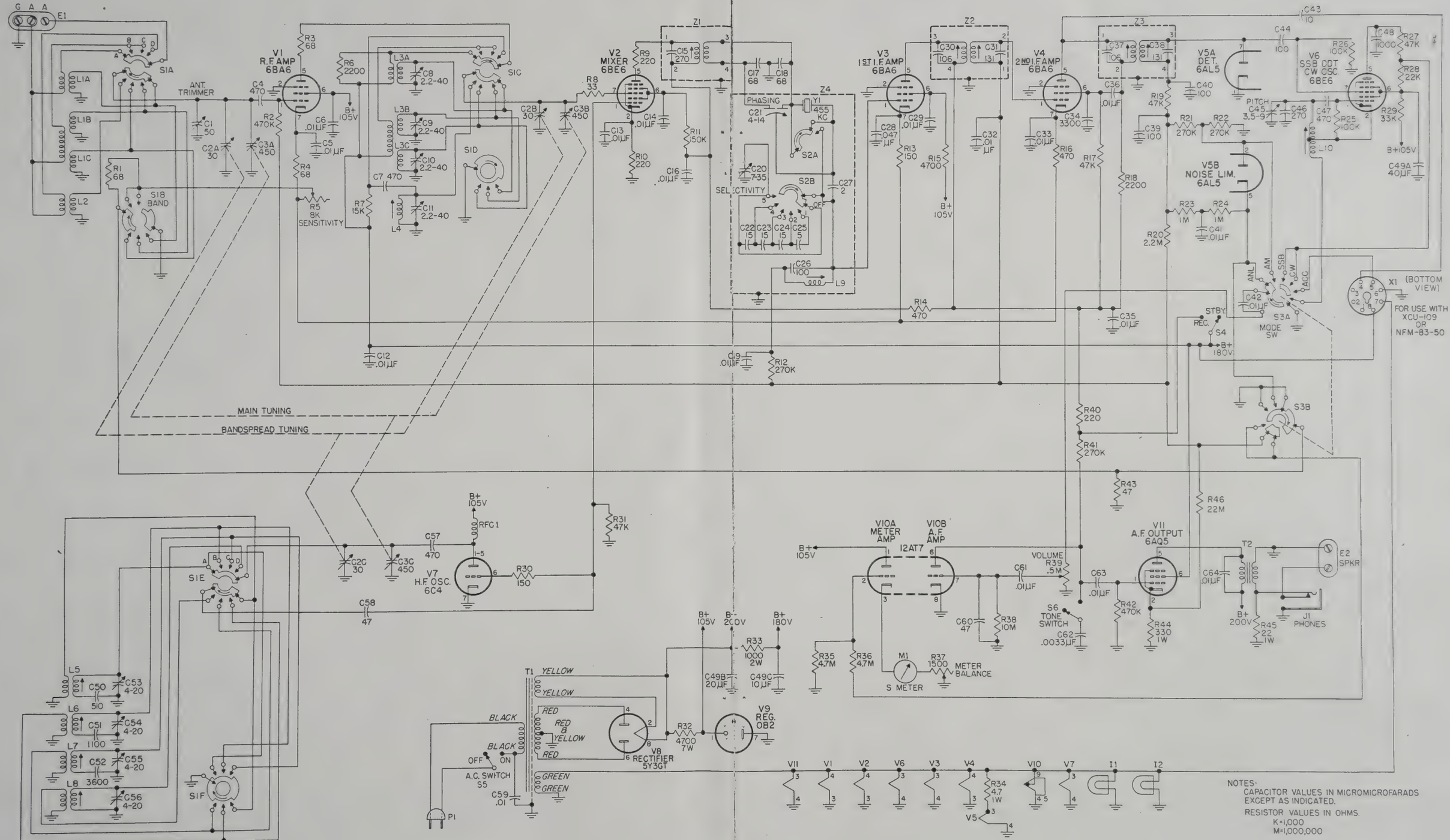
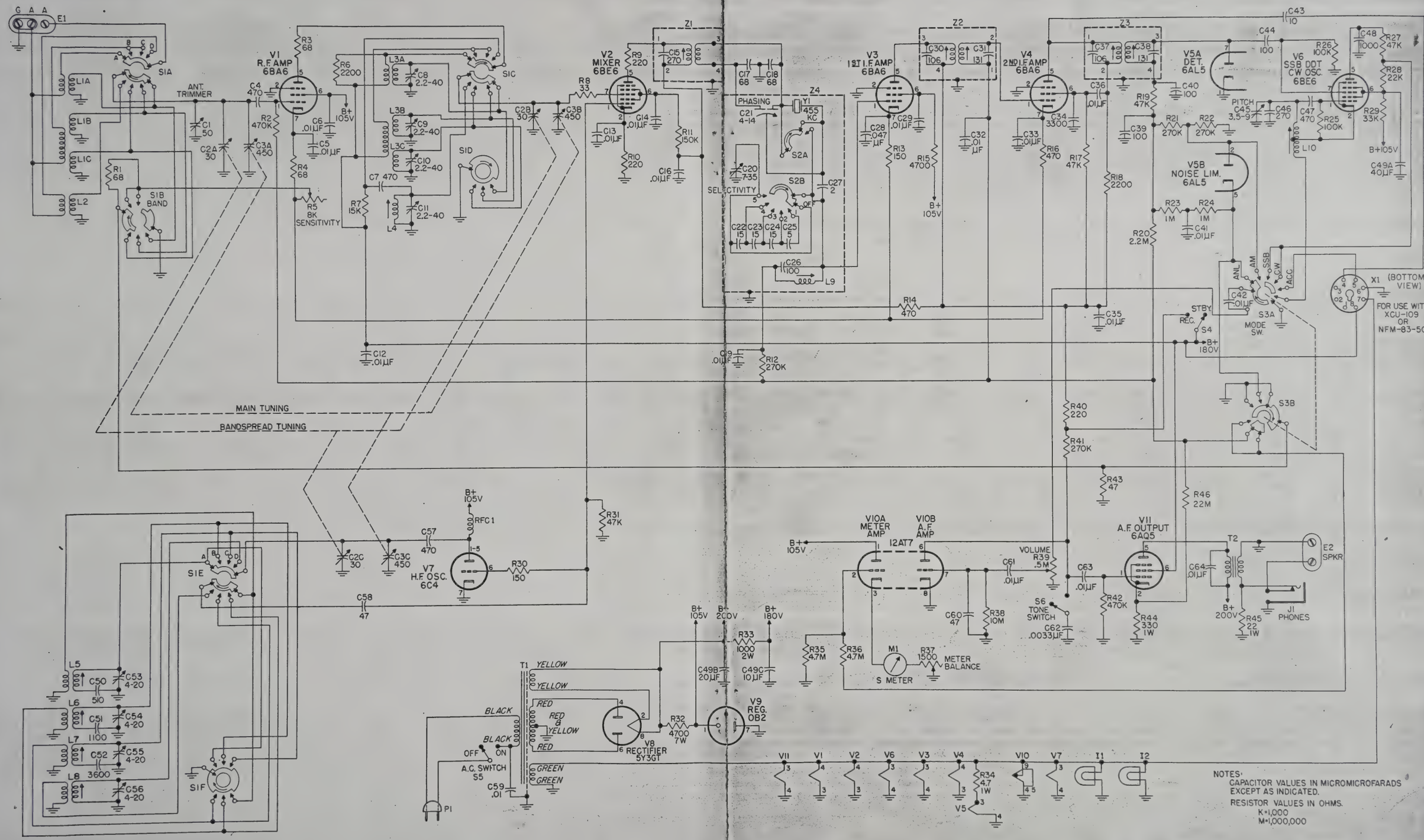
M=1,000,000

NC109 Receiver Schematic Diagram



NOTES:
CAPACITOR VALUES IN MICROMICROFARADS EXCEPT AS INDICATED.
RESISTOR VALUES IN OHMS.
K=1,000
M=1,000,000

NC109 Receiver Schematic Diagram



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NC109 Receiver Schematic Diagram

There are 3
Copies these.
(All NFC-109
The schematic +
covers)

TABLE I

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V1	6BA6	RF Amplifier	V6	6BE6	CW Oscillator and SSB Demodulator
V2	6BE6	Mixer			
V3	6BA6	1st IF Amplifier	V7	6C4	HF Oscillator
V4	6BA6	2nd IF Amplifier	V8	5Y3GT	Rectifier
V5A	½ 6AL5	Detector and AGC	V9	0B2	Voltage Regulator
V5B	½ 6AL5	Noise Limiter	V10A	½ 12AT7	S-meter Amplifier
			V10B	½ 12AT7	Audio Amplifier
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A superheterodyne circuit is used in which signals from the RF amplifier and local oscillator are heterodyned in the mixer producing a 455 kc IF signal. This mixer product is then amplified by two stages of IF amplification and demodulated in the detector. The resulting intelligence is amplified by two audio amplifier stages to a sufficiently high level to drive a loudspeaker or headphones.

The crystal filter provides six degrees of selectivity as shown in the IF selectivity chart, figure 3-3. Bandwidth of the crystal filter varies from 3.8 kc to 50 cycles at 6 db points over the six positions of the SELECTIVITY switch.

A product detector is used for single sideband and CW reception. An extremely stable CW oscillator is used for carrier injection. Sufficient oscillator stability for single sideband reception is ensured by power supply regulation and careful circuit design.

CAUTION

YOUR NC109 IS DESIGNED TO OPERATE FROM A 105 TO 130 VOLT 50 TO 60 CYCLE AC SOURCE ONLY. CONNECTION TO A DC POWER SOURCE WILL RESULT IN SERIOUS DAMAGE.

SECTION 2 INSTALLATION

2.0 UNPACKING

To prevent damaging your receiver when unpacking, the procedure outlined below should be followed:

a. Remove top pad and cover insert.
b. Remove rear insert.
c. Slide receiver back in the carton.
d. Remove front insert.
e. Your receiver will now be free of packing material and may be taken from its carton.

2.1 INITIAL SETUP

Your NC109 has been carefully inspected and tested before shipment and is ready to put into operation. Location of your NC109 should be such that the rear of the receiver is at least two inches from any obstruction to allow adequate ventilation.

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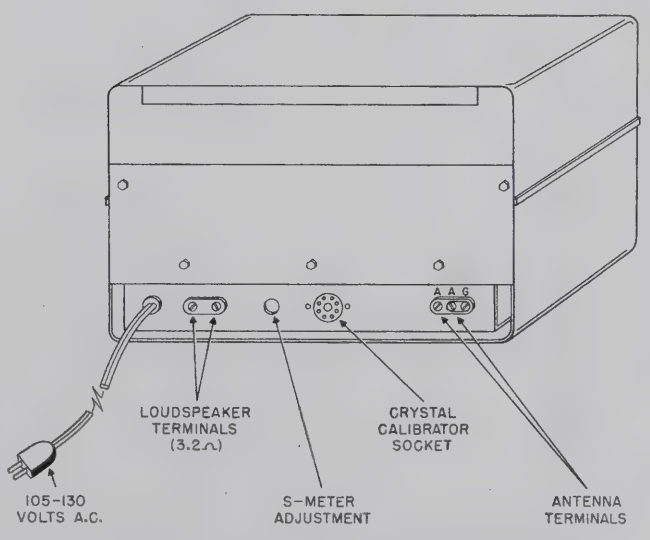
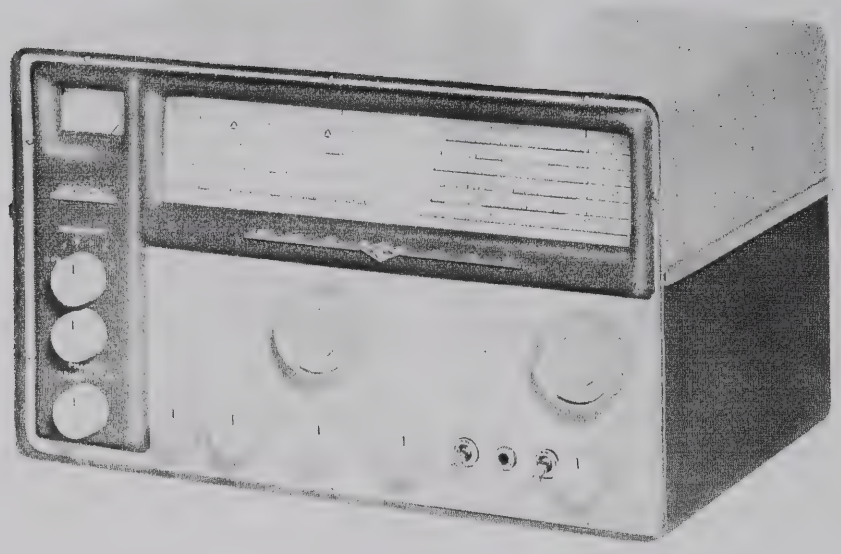


Figure 2-1. Rear View of NC109 Receiver



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SECTION 1 DESCRIPTION

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The frequency range of your NC109, 0.54 to 40.0 mc, covers the amateur, commercial, foreign broadcasts, marine, standard broadcast, and civil defense bands. This frequency range is divided into four tuning bands which are selected by the BAND switch. Frequency ranges of these four bands are as follows:

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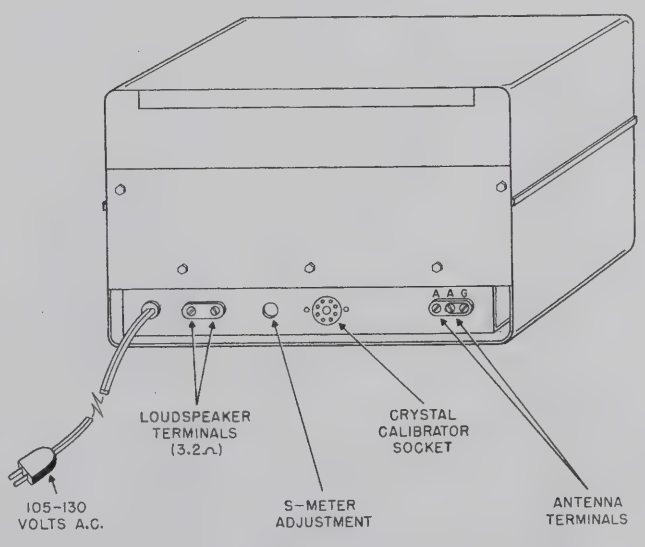

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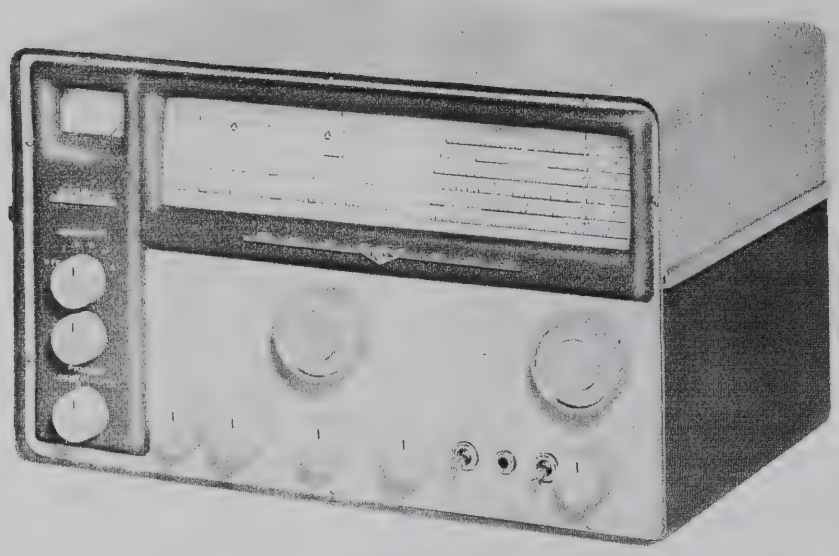

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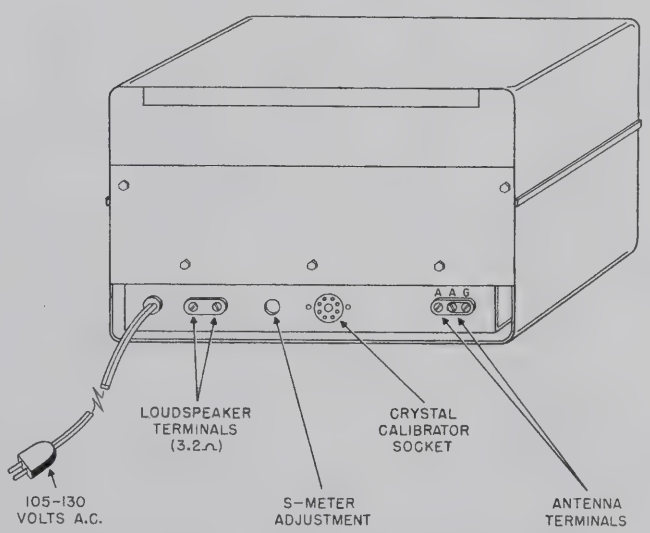

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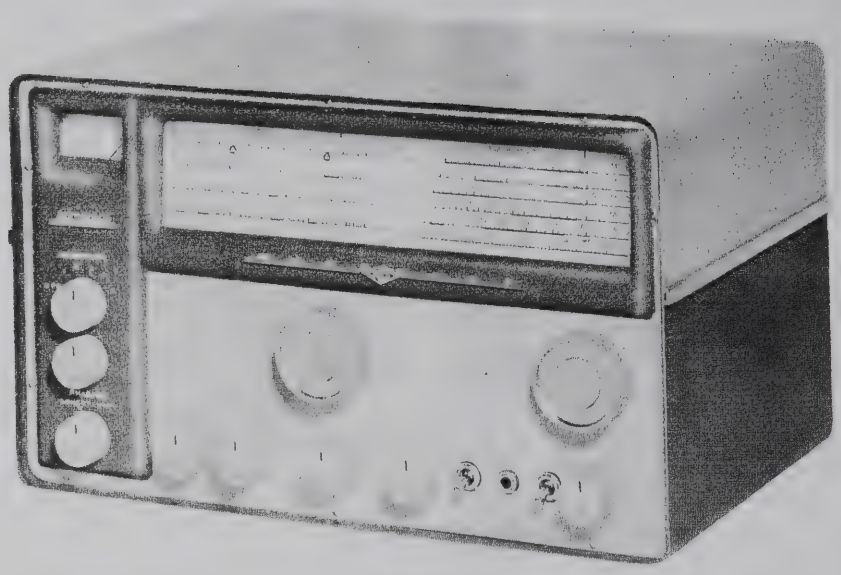

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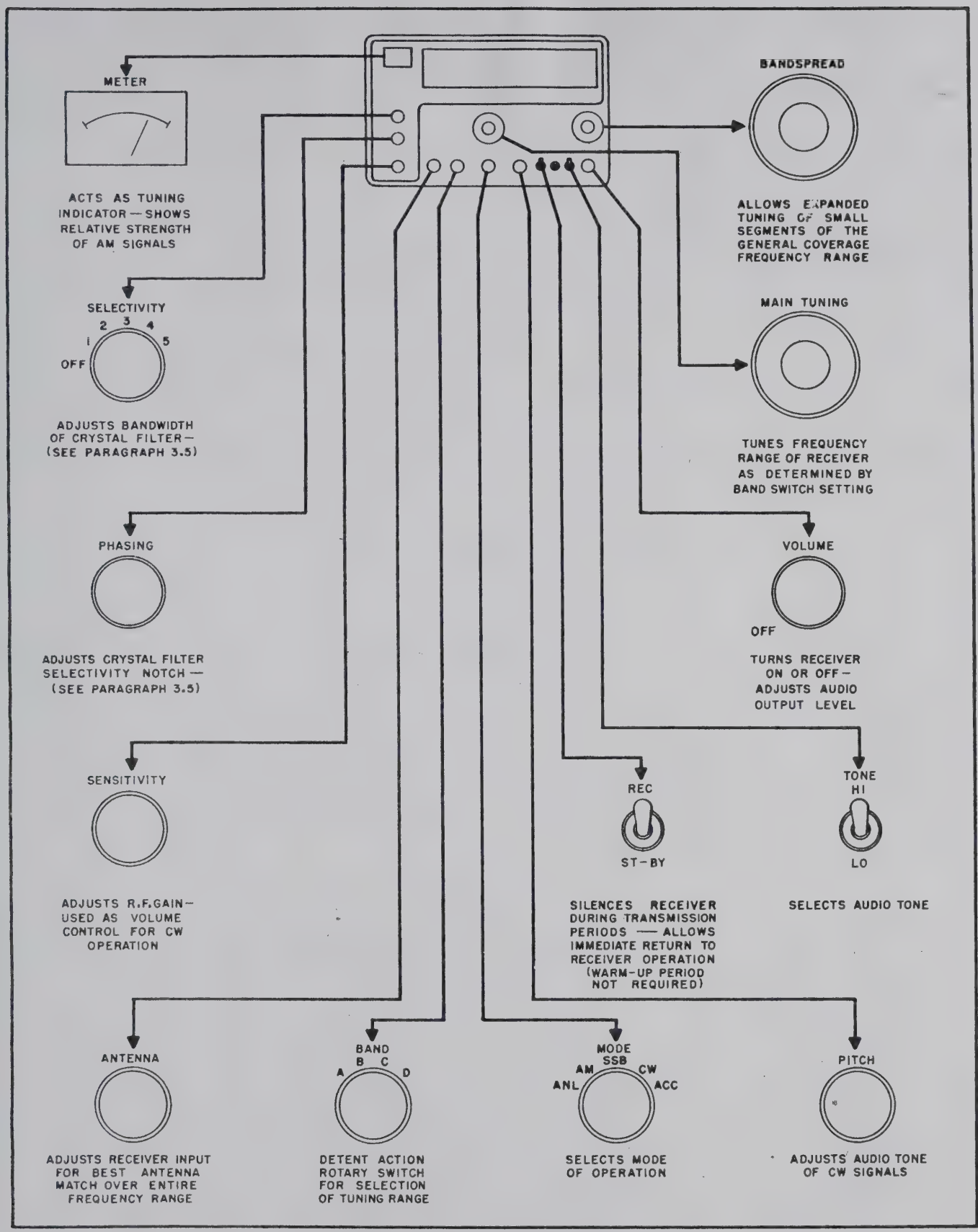
METER
ACTS AS TUNING INDICATOR — SHOWS RELATIVE STRENGTH OF AM SIGNALS
BANDSPREAD
ALLOWS EXPANDED TUNING OF SMALL SEGMENTS OF THE GENERAL COVERAGE FREQUENCY RANGE
SELECTIVITY
1 2 3 4 5
OFF
ADJUSTS BANDWIDTH OF CRYSTAL FILTER — (SEE PARAGRAPH 3.5)
MAIN TUNING
TUNES FREQUENCY RANGE OF RECEIVER AS DETERMINED BY BAND SWITCH SETTING
PHASING
ADJUSTS CRYSTAL FILTER SELECTIVITY NOTCH — (SEE PARAGRAPH 3.5)
VOLUME
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TURNS RECEIVER ON OR OFF — ADJUSTS AUDIO OUTPUT LEVEL
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REC
ST-BY
SILENCES RECEIVER DURING TRANSMISSION PERIODS — ALLOWS IMMEDIATE RETURN TO RECEIVER OPERATION (WARM-UP PERIOD NOT REQUIRED)
TONE
HI
LO
SELECTS AUDIO TONE
ANTENNA
ADJUSTS RECEIVER INPUT FOR BEST ANTENNA MATCH OVER ENTIRE FREQUENCY RANGE
BAND
A B C D
DETENT ACTION ROTARY SWITCH FOR SELECTION OF TUNING RANGE
MODE
SSB
AM CW
ANL ACC
SELECTS MODE OF OPERATION
PITCH
ADJUSTS AUDIO TONE OF CW SIGNALS

Figure 3-1. Location and Function of Controls

A single wire antenna, similar to that illustrated in figure 2-2, may be used quite successfully for general communications reception. In cases where an antenna is desired for better operation in a limited frequency range, a doublet antenna, similar to that illustrated in figure 2-3, is recommended. The lightning arrestors and water pipe ground connections shown in the antenna illustrations are optional.

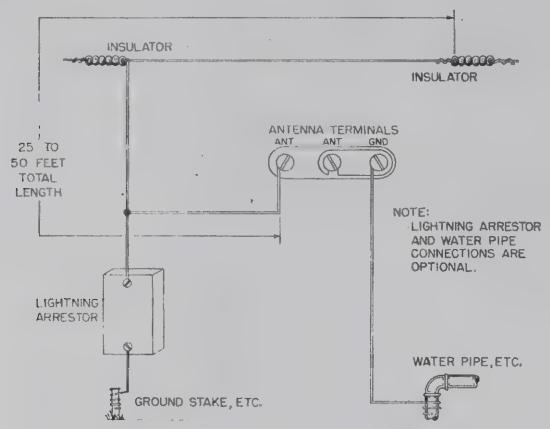


Figure 2-2. Typical Single-Wire Antenna Hookup

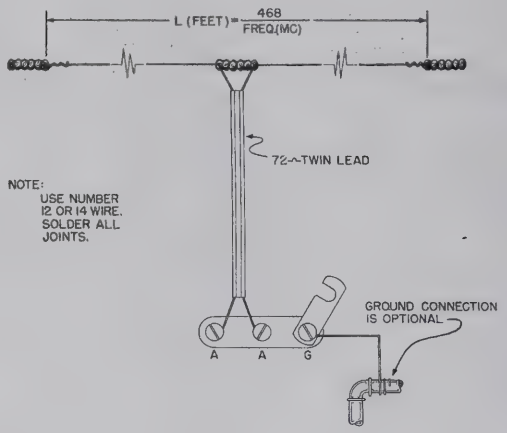


Figure 2-3. Typical Doublet Antenna Hookup

SECTION 3 OPERATION

3.0 CONTROLS

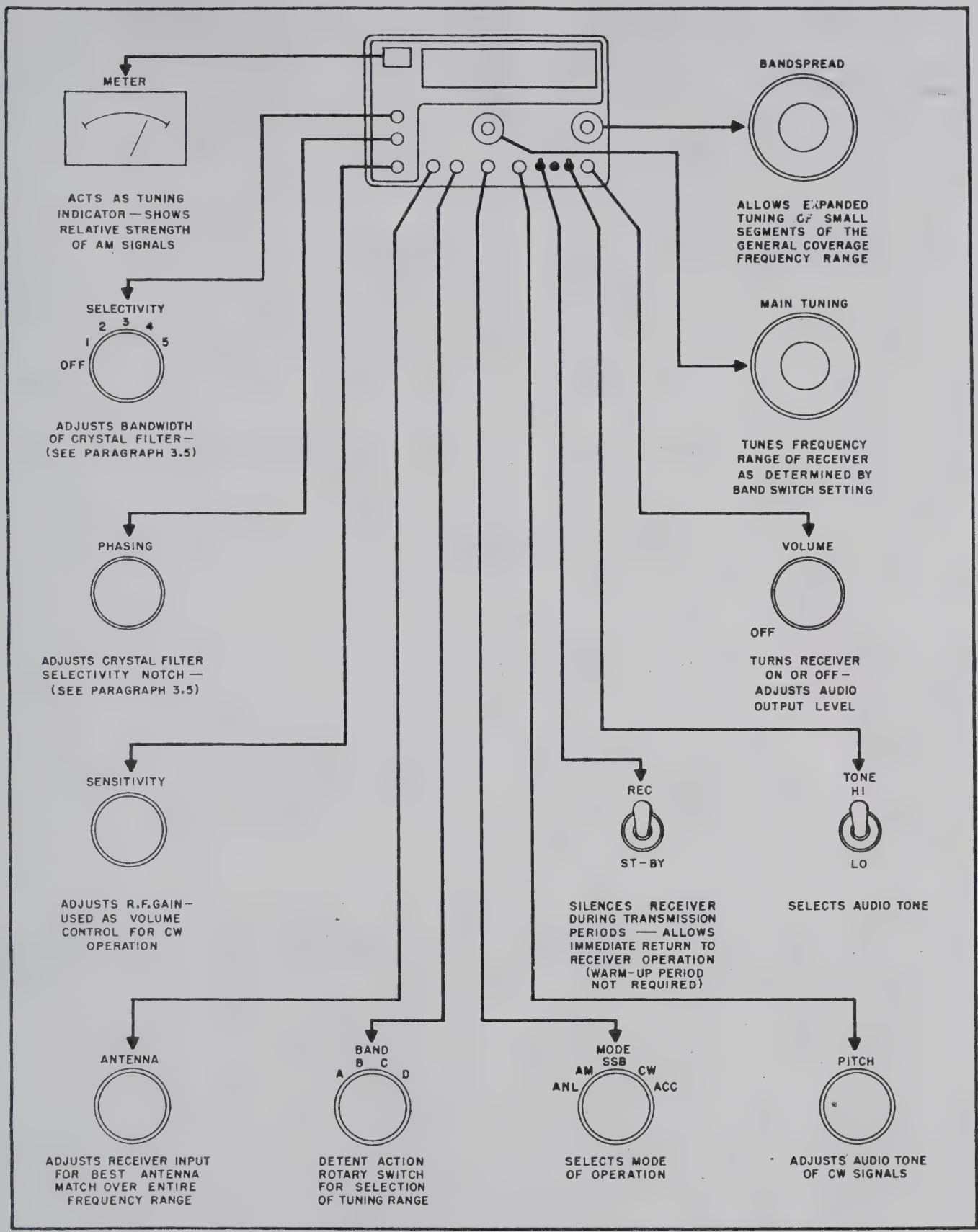
All controls and indicators necessary to operate your NC109 are located on the front panel. The diagram on the following page, (figure 3-1), shows the location of these controls, switches, and indicators and gives a functional description of each part.

3.1 OPERATING PROCEDURES

Initial control and switch settings are shown in Table II.

TABLE II

CONTROL	AM SETTING	SSB SETTING	CW SETTING
SELECTIVITY	OFF	OFF	OFF
PHASING	(par. 3.5)	(par. 3.5)	(par. 3.5)
SENSITIVITY	Maximum	Mid position	Mid position
ANTENNA	Mid position	Mid position	Mid position
BAND	Optional	Optional	Optional
MODE	AM	SSB	CW
PITCH	Inoperative	Mid position	Mid position
REC-STBY	REC	REC	REC
TONE	Optional	Optional	LO
VOLUME	Mid position	Maximum	Maximum
MAIN TUNING	Optional	Optional	Optional
BANDSPREAD	SET	SET	SET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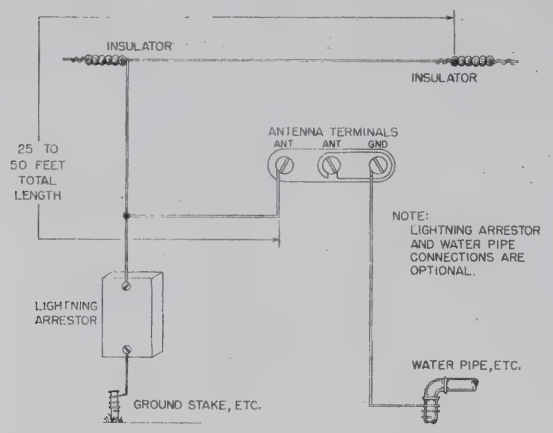

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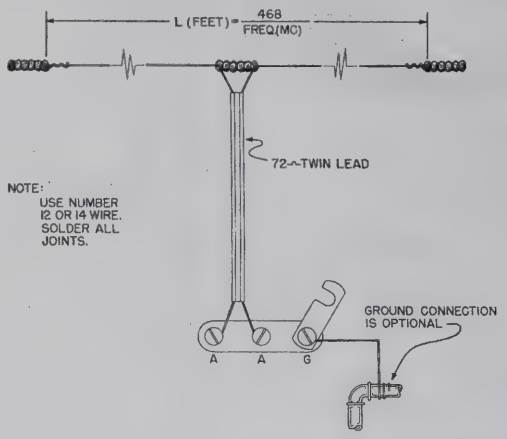

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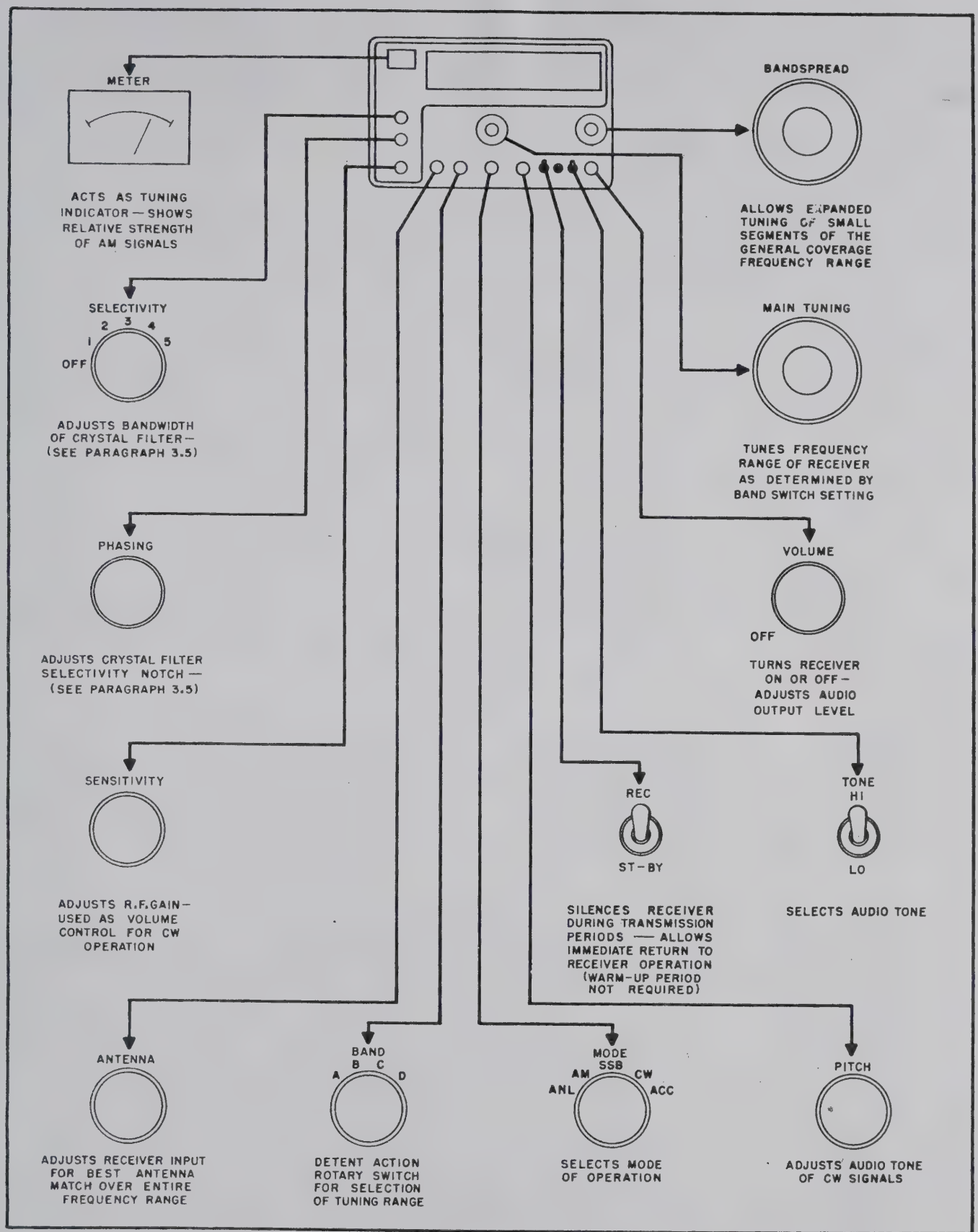
MAIN TUNING	Optional	Optional	Optional
BANDSPREAD	SET	SET	SET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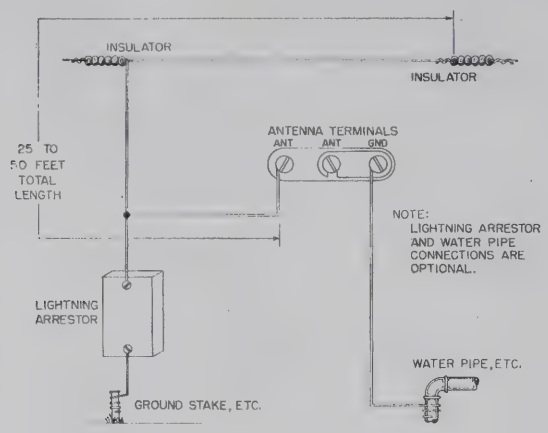

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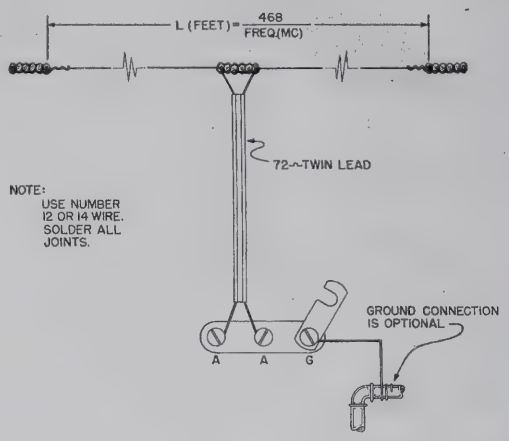

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SENSITIVITY	Maximum	Mid position	Mid position
ANTENNA	Mid position	Mid position	Mid position
BAND	Optional	Optional	Optional
MODE	AM	SSB	CW
PITCH	Inoperative	Mid position	Mid position
REC-STBY	REC	REC	REC
TONE	Optional	Optional	LO
VOLUME	Mid position	Maximum	Maximum
MAIN TUNING	Optional	Optional	Optional
BANDSPREAD	SET	SET	SET

The major amateur radio bands are contained in bands B, C and D. Each amateur band is underlined in black on both the GENERAL COVERAGE and BANDSPREAD scales. On the GENERAL COVERAGE scale the amateur bands are identified by a circle located at the high end of each band which contains the band's wavelength designator ((80) designates the 80 meter amateur band).

Calibration of the GENERAL COVERAGE scale is correct when the BANDSPREAD pointer is in its SET position. For correct calibration of the bandspread scales the GENERAL COVERAGE pointer must be set in the center of the designator circle for the band to be tuned. Figure 3-2 shows the correct pointer positions for bandspreading the 80 meter amateur band.

Short-wave bandspreading, for other than amateur bands, is accomplished by setting the BANDSPREAD pointer at SET and the GENERAL COVERAGE pointer at the high end of the short-wave band to be tuned. Adjust the bandspread control to select the desired station. Notation of the point on the LOG scale where the desired station was located will enable the operator to locate the same station in the future without difficulty.

3.3 MEASUREMENT OF SIGNAL STRENGTH

The S-meter provides a means of measuring the relative strength of incoming AM signals. Accurate measurements of relative signal strength are taken with the SENSITIVITY control set in its extreme clockwise position. These measurements are read in S units from 1 to 9 and in decibels above S9 from 0 to 40 db. The S-meter circuit is disabled under CW and SSB operating conditions.

A screwdriver control, located at the rear of receiver, is provided for zeroing the S-meter electrically. This adjustment is made on "B" band with the antenna disconnected or shorted and the SENSITIVITY control set at maximum.

3.4 SHORT-WAVE LISTENING

Bands B, C and D are the high frequency or short-wave bands. The frequency range of these bands covers short-wave foreign broadcasts, amateur, and commercial radio transmitting stations all over the world. There are literally millions of radio stations in operation today most of which transmit signals within the tuning range of your NC109.

The principal short-wave broadcast stations operate on five major and two minor bands. One characteristic of short-waves is that reception will be good on some bands at certain times of day and, at the same time, poor on other bands. Table III lists the major short-wave broadcast bands, their frequencies and their normal signal strength characteristics at different times of day.

TABLE III

BAND	17 METER	19 METER	25 METER	31 METER	49 METER
FREQUENCY RANGE	17.7-17.9 mc	15.1-15.45 mc	11.7-11.95 mc	9.6-9.8 mc	6.0-6.2 mc
SUNRISE TO NOON	Eastern stations good	Same as 17 meter	West and southwest good	Same as 25 meter	Same as 25 meter
NOON TO SUNSET	South good	East and south good	Same as 19 meter	East good	Most signals weak
SUNSET TO MIDNIGHT	Stations fade-band goes dead	Same as 17 meter	East fades south strong	Same as 25 meter	North, south and east very good

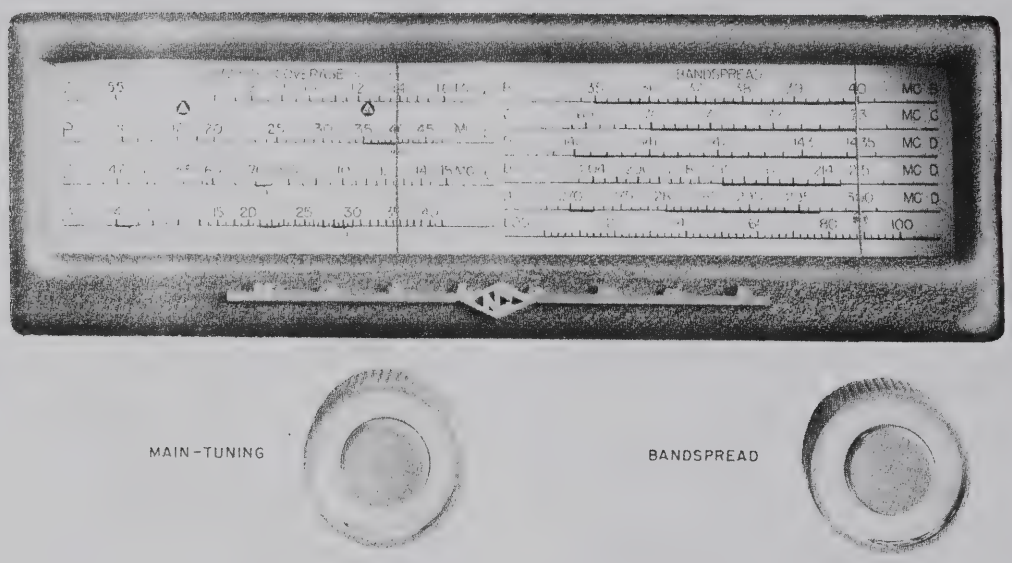

Figure 3-2. NC109 Dial Scales and Tuning Controls

3.1.1 AM Operation

The following adjustments will be necessary during operation:

a. Select frequency range by positioning BAND switch.

b. Set the GENERAL COVERAGE dial pointer in the band to be tuned at a spot where no signal is heard and adjust the ANTENNA control for maximum background noise. This setting is satisfactory while operating over a limited frequency range.

c. Adjust the MAIN TUNING control to select a signal.

d. Adjust VOLUME for a comfortable listening level.

e. If excessive spurious noises are heard, (auto ignition, etc.), place the MODE switch in its ANL position. Automatic noise limiting reduces fidelity and therefore should be used only when necessary.

3.1.2 CW Operation

a. The SENSITIVITY control is used as a volume control for CW operation and should be adjusted accordingly.

b. Adjust the PITCH control for a pleasing note.

c. All other adjustments are the same as for AM operation.

3.1.3 Single Sideband Operation

The recent upsurge in single sideband activity by amateur radio operators makes it necessary for a communications receiver to have a beat-frequency oscillator that is sufficiently stable to produce a constant carrier injection signal, and a system of demodulation capable of reproducing single sideband intelligence without strong harmonic distortion. Both of these requirements are fulfilled by your NC109.

The procedure for tuning single sideband signals with your NC109 is relatively simple. First, set up your receiver for bandspread tuning an amateur band (as described in paragraph 3.2). Set the MODE switch at AM and the PITCH control to its center position. Adjust the BANDSPREAD control to locate a single sideband signal (identified by its "garbled" sound). Set the VOLUME control at maximum. Carefully tune for maximum S-meter deflection. Set the MODE switch to SSB and adjust the PITCH control slightly to either side of center until the "garble" clears and a readable signal is obtained. The SENSITIVITY control is used as a volume control for SSB reception.

3.2 TUNING

The GENERAL COVERAGE and BANDSPREAD scales (figure 3-2) are calibrated in megacycles and contain special markings to simplify tuning. The CONELRAD frequencies, .64 and 12.4 mc, are indicated on band A by the civil defense symbol

The major amateur radio bands are contained in bands B, C and D. Each amateur band is underlined in black on both the GENERAL COVERAGE and BANDSPREAD scales. On the GENERAL COVERAGE scale the amateur bands are identified by a circle located at the high end of each band which contains the band's wavelength designator ((80) designates the 80 meter amateur band).

Calibration of the GENERAL COVERAGE scale is correct when the BANDSPREAD pointer is in its SET position. For correct calibration of the bandspread scales the GENERAL COVERAGE pointer must be set in the center of the designator circle for the band to be tuned. Figure 3-2 shows the correct pointer positions for bandspreading the 80 meter amateur band.

Short-wave bandspreading, for other than amateur bands, is accomplished by setting the BANDSPREAD pointer at SET and the GENERAL COVERAGE pointer at the high end of the short-wave band to be tuned. Adjust the bandspread control to select the desired station. Notation of the point on the LOG scale where the desired station was located will enable the operator to locate the same station in the future without difficulty.

3.3 MEASUREMENT OF SIGNAL STRENGTH

The S-meter provides a means of measuring the relative strength of incoming AM signals. Accurate measurements of relative signal strength are taken with the SENSITIVITY control set in its extreme clockwise position. These measurements are read in S units from 1 to 9 and in decibels above S9 from 0 to 40 db. The S-meter circuit is disabled under CW and SSB operating conditions.

A screwdriver control, located at the rear of receiver, is provided for zeroing the S-meter electrically. This adjustment is made on "B" band with the antenna disconnected or shorted and the SENSITIVITY control set at maximum.

3.4 SHORT-WAVE LISTENING

Bands B, C and D are the high frequency or short-wave bands. The frequency range of these bands covers short-wave foreign broadcasts, amateur, and commercial radio transmitting stations all over the world. There are literally millions of radio stations in operation today most of which transmit signals within the tuning range of your NC109.

The principal short-wave broadcast stations operate on five major and two minor bands. One characteristic of short-waves is that reception will be good on some bands at certain times of day and, at the same time, poor on other bands. Table III lists the major short-wave broadcast bands, their frequencies and their normal signal strength characteristics at different times of day.

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BAND	17 METER	19 METER	25 METER	31 METER	49 METER
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SUNRISE TO NOON	Eastern stations good	Same as 17 meter	West and southwest good	Same as 25 meter	Same as 25 meter
NOON TO SUNSET	South good	East and south good	Same as 19 meter	East good	Most signals weak
SUNSET TO MIDNIGHT	Stations fade-band goes dead	Same as 17 meter	East fades south strong	Same as 25 meter	North, south and east very good

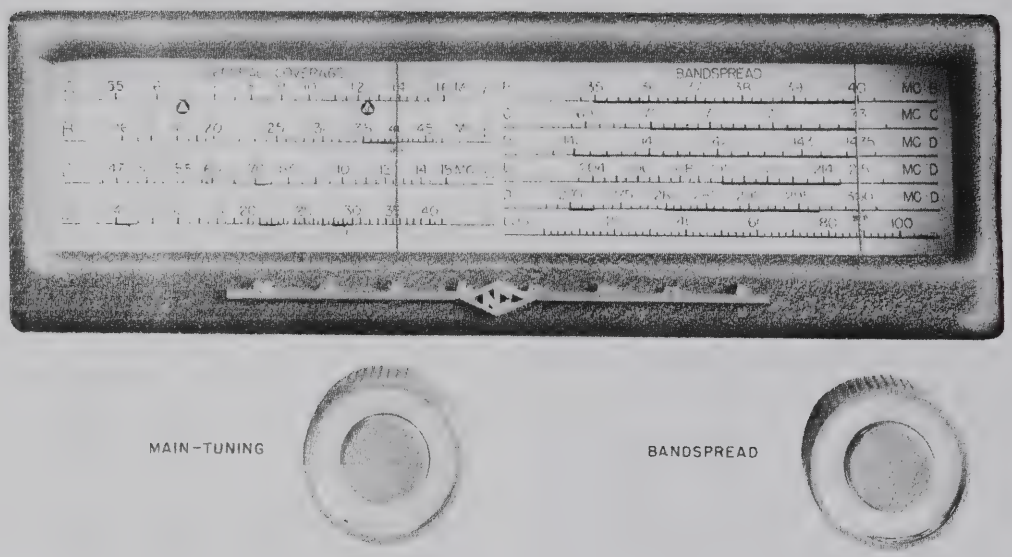

Figure 3-2. NC109 Dial Scales and Tuning Controls

3.1.1 AM Operation

The following adjustments will be necessary during operation:

a. Select frequency range by positioning BAND switch.

b. Set the GENERAL COVERAGE dial pointer in the band to be tuned at a spot where no signal is heard and adjust the ANTENNA control for maximum background noise. This setting is satisfactory while operating over a limited frequency range.

c. Adjust the MAIN TUNING control to select a signal.

d. Adjust VOLUME for a comfortable listening level.

e. If excessive spurious noises are heard, (auto ignition, etc.), place the MODE switch in its ANL position. Automatic noise limiting reduces fidelity and therefore should be used only when necessary.

3.1.2 CW Operation

a. The SENSITIVITY control is used as a volume control for CW operation and should be adjusted accordingly.

b. Adjust the PITCH control for a pleasing note.

c. All other adjustments are the same as for AM operation.

3.1.3 Single Sideband Operation

The recent upsurge in single sideband activity by amateur radio operators makes it necessary for a communications receiver to have a beat-frequency oscillator that is sufficiently stable to produce a constant carrier injection signal, and a system of demodulation capable of reproducing single sideband intelligence without strong harmonic distortion. Both of these requirements are fulfilled by your NC109.

The procedure for tuning single sideband signals with your NC109 is relatively simple. First, set up your receiver for bandspread tuning an amateur band (as described in paragraph 3.2). Set the MODE switch at AM and the PITCH control to its center position. Adjust the BANDSPREAD control to locate a single sideband signal (identified by its "garbled" sound). Set the VOLUME control at maximum. Carefully tune for maximum S-meter deflection. Set the MODE switch to SSB and adjust the PITCH control slightly to either side of center until the "garble" clears and a readable signal is obtained. The SENSITIVITY control is used as a volume control for SSB reception.

3.2 TUNING

The GENERAL COVERAGE and BANDSPREAD scales (figure 3-2) are calibrated in megacycles and contain special markings to simplify tuning. The CONELRAD frequencies, .64 and 12.4 mc, are indicated on band A by the civil defense symbol

The major amateur radio bands are contained in bands B, C and D. Each amateur band is underlined in black on both the GENERAL COVERAGE and BANDSPREAD scales. On the GENERAL COVERAGE scale the amateur bands are identified by a circle located at the high end of each band which contains the band's wavelength designator ((80) designates the 80 meter amateur band).

Calibration of the GENERAL COVERAGE scale is correct when the BANDSPREAD pointer is in its SET position. For correct calibration of the bandspread scales the GENERAL COVERAGE pointer must be set in the center of the designator circle for the band to be tuned. Figure 3-2 shows the correct pointer positions for bandspreading the 80 meter amateur band.

Short-wave bandspreading, for other than amateur bands, is accomplished by setting the BANDSPREAD pointer at SET and the GENERAL COVERAGE pointer at the high end of the short-wave band to be tuned. Adjust the bandspread control to select the desired station. Notation of the point on the LOG scale where the desired station was located will enable the operator to locate the same station in the future without difficulty.

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A screwdriver control, located at the rear of receiver, is provided for zeroing the S-meter electrically. This adjustment is made on "B" band with the antenna disconnected or shorted and the SENSITIVITY control set at maximum.

3.4 SHORT-WAVE LISTENING

Bands B, C and D are the high frequency or short-wave bands. The frequency range of these bands covers short-wave foreign broadcasts, amateur, and commercial radio transmitting stations all over the world. There are literally millions of radio stations in operation today most of which transmit signals within the tuning range of your NC109.

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SUNRISE TO NOON	Eastern stations good	Same as 17 meter	West and southwest good	Same as 25 meter	Same as 25 meter
NOON TO SUNSET	South good	East and south good	Same as 19 meter	East good	Most signals weak
SUNSET TO MIDNIGHT	Stations fade-band goes dead	Same as 17 meter	East fades south strong	Same as 25 meter	North, south and east very good

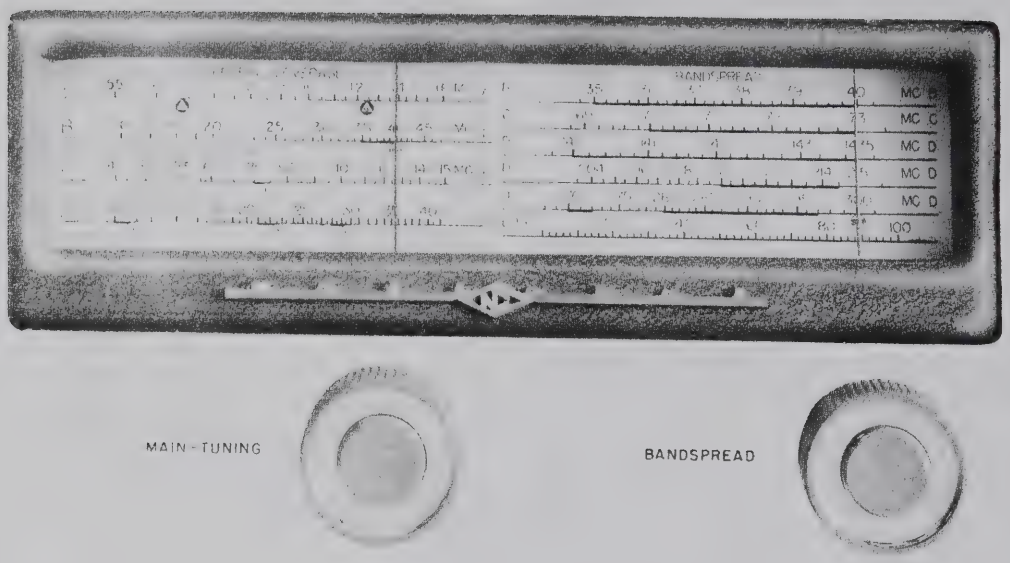


Figure 3-2. NC109 Dial Scales and Tuning Controls

3.1.1 AM Operation

The following adjustments will be necessary during operation:

a. Select frequency range by positioning BAND switch.

b. Set the GENERAL COVERAGE dial pointer in the band to be tuned at a spot where no signal is heard and adjust the ANTENNA control for maximum background noise. This setting is satisfactory while operating over a limited frequency range.

c. Adjust the MAIN TUNING control to select a signal.

d. Adjust VOLUME for a comfortable listening level.

e. If excessive spurious noises are heard, (auto ignition, etc.), place the MODE switch in its ANL position. Automatic noise limiting reduces fidelity and therefore should be used only when necessary.

3.1.2 CW Operation

a. The SENSITIVITY control is used as a volume control for CW operation and should be adjusted accordingly.

b. Adjust the PITCH control for a pleasing note.

c. All other adjustments are the same as for AM operation.

3.1.3 Single Sideband Operation

The recent upsurge in single sideband activity by amateur radio operators makes it necessary for a communications receiver to have a beat-frequency oscillator that is sufficiently stable to produce a constant carrier injection signal, and a system of demodulation capable of reproducing single sideband intelligence without strong harmonic distortion. Both of these requirements are fulfilled by your NC109.

The procedure for tuning single sideband signals with your NC109 is relatively simple. First, set up your receiver for bandspread tuning an amateur band (as described in paragraph 3.2). Set the MODE switch at AM and the PITCH control to its center position. Adjust the BANDSPREAD control to locate a single sideband signal (identified by its "garbled" sound). Set the VOLUME control at maximum. Carefully tune for maximum S-meter deflection. Set the MODE switch to SSB and adjust the PITCH control slightly to either side of center until the "garble" clears and a readable signal is obtained. The SENSITIVITY control is used as a volume control for SSB reception.

3.2 TUNING

The GENERAL COVERAGE and BANDSPREAD scales (figure 3-2) are calibrated in megacycles and contain special markings to simplify tuning. The CONELRAD frequencies, .64 and 12.4 mc, are indicated on band A by the civil defense symbol

SECTION 4 MAINTENANCE

4.1 GENERAL

Information contained in this section will aid qualified service personnel in servicing and aligning your NC109.

4.2 REMOVING THE CHASSIS

All knobs, the rear cover and cabinet feet must be removed before the chassis can be taken out of the cabinet. All knobs are push-on type except the two large tuning knobs which are held in place by set screws. The rear cover is held on by five screws. Recessed screws in the cabinet feet hold the chassis in the cabinet.

4.3 TEST EQUIPMENT

The following test equipment is required to align your NC109.

a. AM signal generator having:
   (1) 30% modulation at 400 cps.
   (2) Frequency range from 455 kc to 30 mc.

b. Output meter.

c. Accurate frequency standard (XCU-109)

4.4 IF ALIGNMENT

IF alignment must be made at the frequency of the crystal in Z4. Connect a signal generator to the main tuning condenser mixer stator. Set the SENSITIVITY and VOLUME controls at maximum. Remove modulation from the input signal. Set the SELECTIVITY switch to 5 and input level to 200 microvolts. Tune the generator around 455 kc until a sharp peak is obtained on the S-meter. The generator is now tuned to the crystal frequency. Set the MODE switch to CW. With the dot on the PITCH control vertical, set the BFO to zero-beat by adjusting the slug in L10. Set the MODE switch to AM and modulate the input signal. Set the SELECTIVITY switch to OFF and adjust Z1, Z2 and Z3 for maximum audio output keeping the output level around 100 milliwatts by adjusting the input level. With modulation off and the generator tuned to crystal frequency, set the MODE switch to CW. Set the PHASING and PITCH controls with their dots vertical. The BFO should nearly zero-beat with the generator frequency. Set the SELECTIVITY switch to 1 and detune the generator approximately 2 kc in either direction. Adjust the slug in Z4 for maximum audio output. Check the PHASING control by adjusting it to a position where the beat note is completely eliminated. Repeat this check with the generator detuned to the other side of zero-beat. (Complete elimination of the beat note should be possible.) The two phasing positions should occur near the center of the PHASING control range. Tune the generator to the crystal frequency with modulation on. Set the MODE switch to AM, SELECTIVITY to OFF and adjust C20 in Z4 for maximum audio output. The IF section is now properly aligned.

TABLE IV RF CHART

BAND	A	B	C	D
SET GENERATOR	.6 mc	1.6 mc	5 mc	14 mc
SET MAIN TUNING	.6 mc	1.6 mc	5 mc	14 mc
ADJUST TO TUNE	L-5	L-6	L-7	L-8
SET GENERATOR			5.5 mc	16 mc
SET MAIN TUNING			To signal	To signal
ADJUST FOR MAXIMUM			Loop in L-1c Loop in L-3c	L-2 L-4
SET GENERATOR	1.5 mc	4 mc	14 mc	30 mc
SET MAIN TUNING	1.5 mc	4 mc	14 mc	30 mc
ADJUST TO TUNE	C-53	C-54	C-55	C-56
ADJUST FOR MAX.	C-8	C-9	C-10	——
SET MAIN TUNING				26 mc
ADJUST FOR MAXIMUM NOISE				C-11

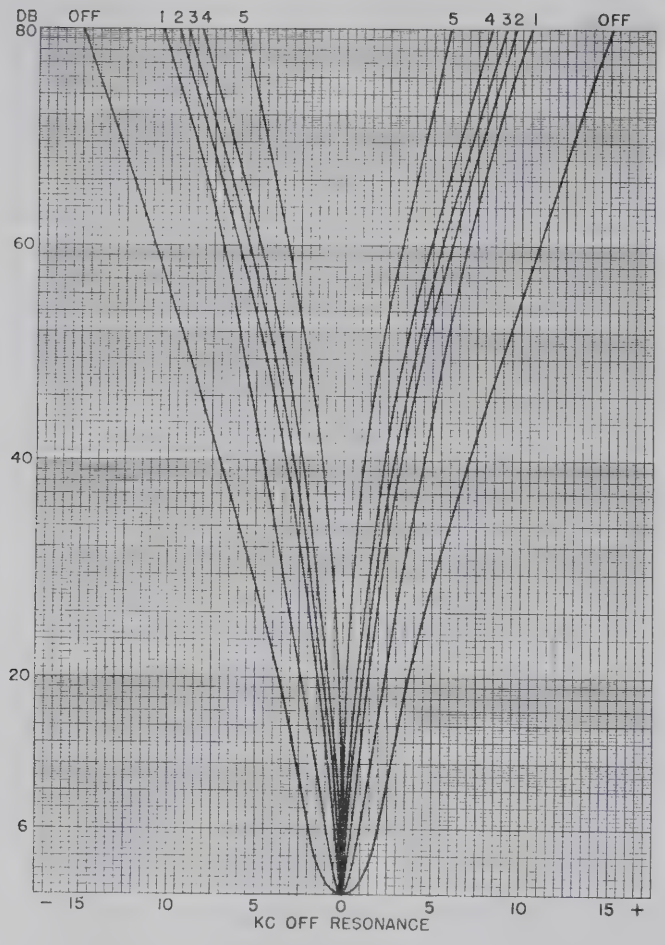


Figure 3-3. IF Selectivity Characteristics

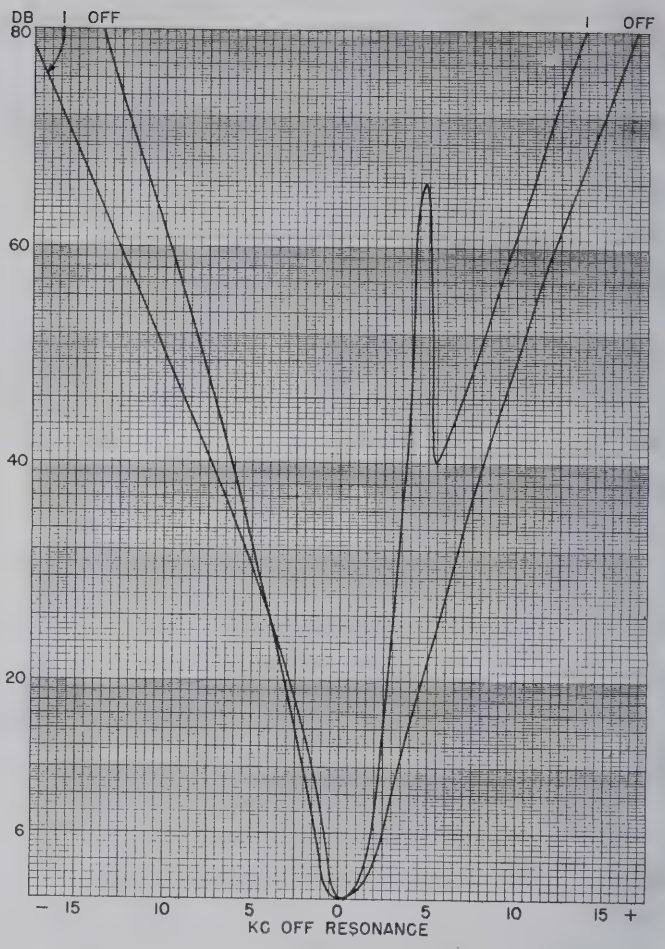


Figure 3-4. Crystal Filter Selectivity Characteristics

3.5 CRYSTAL FILTER OPERATION

A crystal filter circuit, located in the first IF amplifier stage, is used to control the selectivity of your NC109. The SELECTIVITY and PHASING controls are used to operate this filter. Bandwidths of the filter range from 3.8 kc in the OFF position to 50 cps in position 5 of the SELECTIVITY control as illustrated in figure 3-3. The PHASING control provides a means of suppressing interfering CW or MCW signals which may produce objectionable heterodynes.

Under normal AM operating conditions, the SELECTIVITY control is used in the OFF position. If interference to the desired signal is present the SELECTIVITY control may be set to position 1 or 2. Selectivity sharper than this usually causes too great a loss of fidelity to be useful for AM operation. When using the crystal filter for AM reception, the signal should be tuned to a peak on the S-meter. The PHASING control can then be used to eliminate interfering heterodynes. If the receiver is properly tuned the PHASING control will have no effect on the signal.

Any position of the SELECTIVITY control may be used for CW reception depending on the degree of selectivity required. Position 5 will give the sharpest selectivity with the greatest freedom from interference and lowest background noise level but can only be used on very stable signals. The PHASING control introduces a "notch" (see curve of figure 3-4) which may be moved through the bandwidth of the filter to eliminate interfering signals.

SECTION 4 MAINTENANCE

4.1 GENERAL

Information contained in this section will aid qualified service personnel in servicing and aligning your NC109.

4.2 REMOVING THE CHASSIS

All knobs, the rear cover and cabinet feet must be removed before the chassis can be taken out of the cabinet. All knobs are push-on type except the two large tuning knobs which are held in place by set screws. The rear cover is held on by five screws. Recessed screws in the cabinet feet hold the chassis in the cabinet.

4.3 TEST EQUIPMENT

The following test equipment is required to align your NC109.

a. AM signal generator having:
   (1) 30% modulation at 400 cps.
   (2) Frequency range from 455 kc to 30 mc.

b. Output meter.

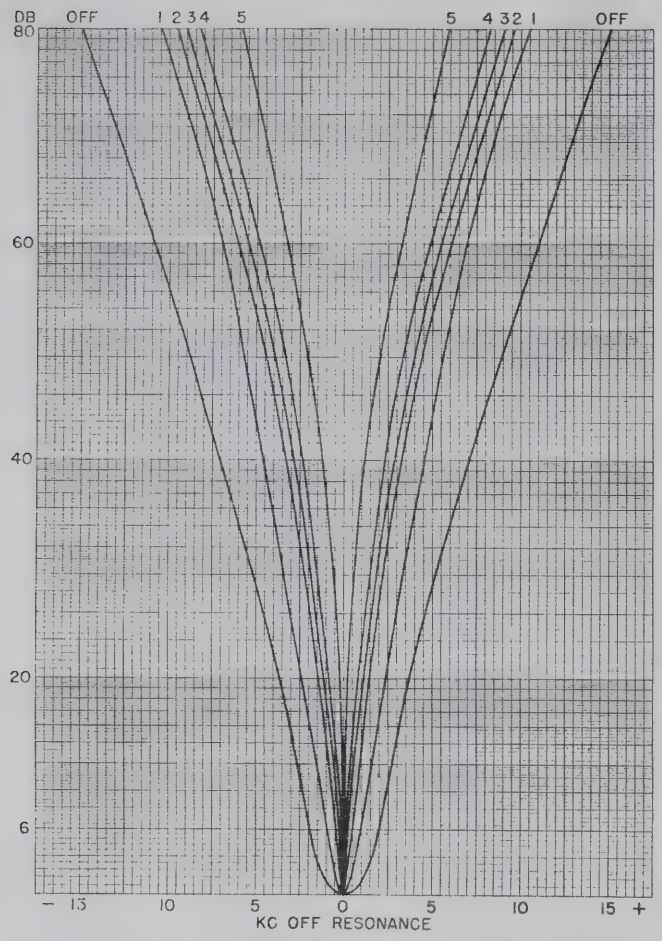
c. Accurate frequency standard (XCU-109)

4.4 IF ALIGNMENT

IF alignment must be made at the frequency of the crystal in Z4. Connect a signal generator to the main tuning condenser mixer stator. Set the SENSITIVITY and VOLUME controls at maximum. Remove modulation from the input signal. Set the SELECTIVITY switch to 5 and input level to 200 microvolts. Tune the generator around 455 kc until a sharp peak is obtained on the S-meter. The generator is now tuned to the crystal frequency. Set the MODE switch to CW. With the dot on the PITCH control vertical, set the BFO to zero-beat by adjusting the slug in L10. Set the MODE switch to AM and modulate the input signal. Set the SELECTIVITY switch to OFF and adjust Z1, Z2 and Z3 for maximum audio output keeping the output level around 100 milliwatts by adjusting the input level. With modulation off and the generator tuned to crystal frequency, set the MODE switch to CW. Set the PHASING and PITCH controls with their dots vertical. The BFO should nearly zero-beat with the generator frequency. Set the SELECTIVITY switch to 1 and detune the generator approximately 2 kc in either direction. Adjust the slug in Z4 for maximum audio output. Check the PHASING control by adjusting it to a position where the beat note is completely eliminated. Repeat this check with the generator detuned to the other side of zero-beat. (Complete elimination of the beat note should be possible.) The two phasing positions should occur near the center of the PHASING control range. Tune the generator to the crystal frequency with modulation on. Set the MODE switch to AM, SELECTIVITY to OFF and adjust C20 in Z4 for maximum audio output. The IF section is now properly aligned.

TABLE IV RF CHART

BAND	A	B	C	D
SET GENERATOR	.6 mc	1.6 mc	5 mc	14 mc
SET MAIN TUNING	.6 mc	1.6 mc	5 mc	14 mc
ADJUST TO TUNE	L-5	L-6	L-7	L-8
SET GENERATOR			5.5 mc	16 mc
SET MAIN TUNING			To signal	To signal
ADJUST FOR MAXIMUM			Loop in L-1c Loop in L-3c	L-2 L-4
SET GENERATOR	1.5 mc	4 mc	14 mc	30 mc
SET MAIN TUNING	1.5 mc	4 mc	14 mc	30 mc
ADJUST TO TUNE	C-53	C-54	C-55	C-56
ADJUST FOR MAX.	C-8	C-9	C-10	——
SET MAIN TUNING				26 mc
ADJUST FOR MAXIMUM NOISE				C-11



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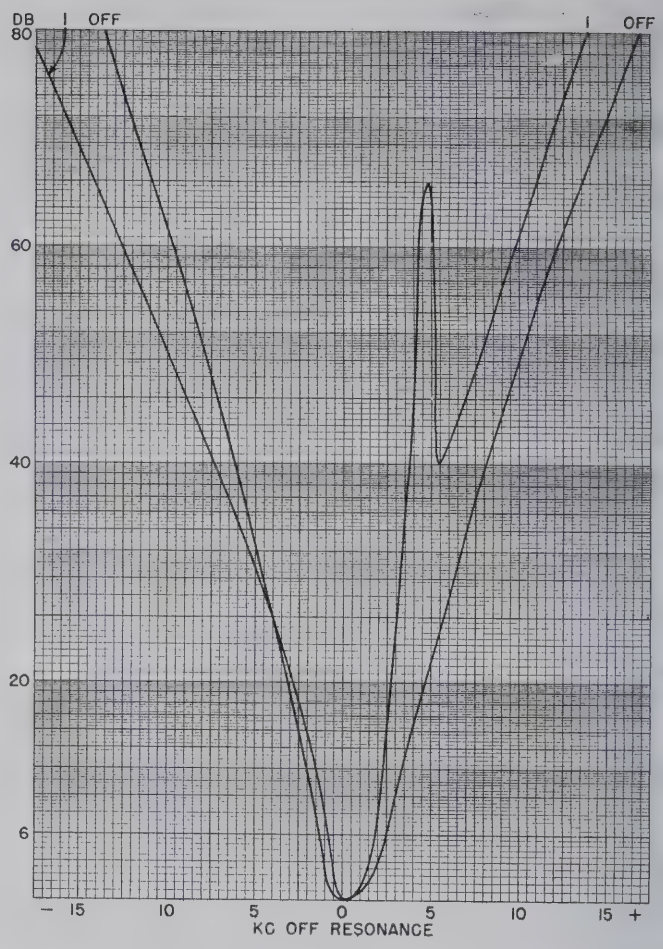

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TABLE IV RF CHART

BAND	A	B	C	D
SET GENERATOR	.6 mc	1.6 mc	5 mc	14 mc
SET MAIN TUNING	.6 mc	1.6 mc	5 mc	14 mc
ADJUST TO TUNE	L-5	L-6	L-7	L-8
SET GENERATOR			5.5 mc	16 mc
SET MAIN TUNING			To signal	To signal
ADJUST FOR MAXIMUM			Loop in L-1c Loop in L-3c	L-2 L-4
SET GENERATOR	1.5 mc	4 mc	14 mc	30 mc
SET MAIN TUNING	1.5 mc	4 mc	14 mc	30 mc
ADJUST TO TUNE	C-53	C-54	C-55	C-56
ADJUST FOR MAX.	C-8	C-9	C-10	——
SET MAIN TUNING				26 mc
ADJUST FOR MAXIMUM NOISE				C-11

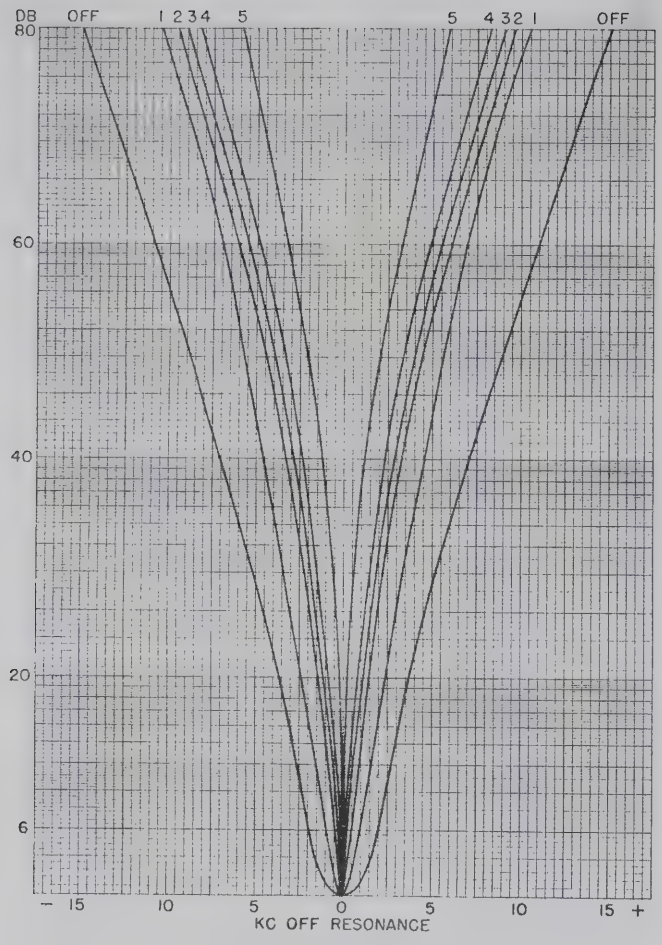

Figure 3-3. IF Selectivity Characteristics

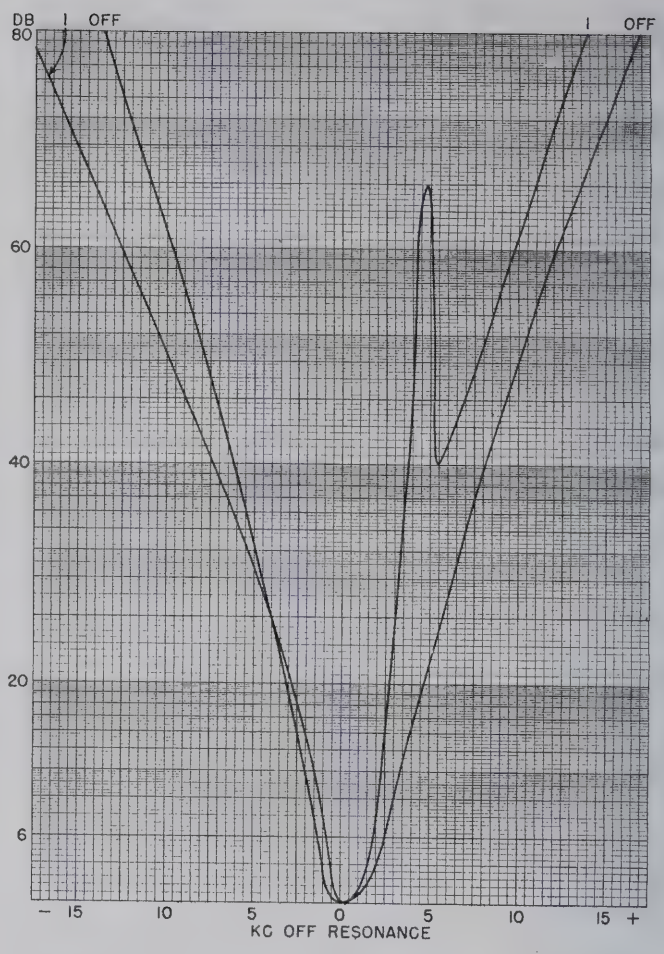

Figure 3-4. Crystal Filter Selectivity Characteristics

3.5 CRYSTAL FILTER OPERATION

A crystal filter circuit, located in the first IF amplifier stage, is used to control the selectivity of your NC109. The SELECTIVITY and PHASING controls are used to operate this filter. Bandwidths of the filter range from 3.8 kc in the OFF position to 50 cps in position 5 of the SELECTIVITY control as illustrated in figure 3-3. The PHASING control provides a means of suppressing interfering CW or MCW signals which may produce objectionable heterodynes.

Under normal AM operating conditions, the SELECTIVITY control is used in the OFF position. If interference to the desired signal is present the SELECTIVITY control may be set to position 1 or 2. Selectivity sharper than this usually causes too great a loss of fidelity to be useful for AM operation. When using the crystal filter for AM reception, the signal should be tuned to a peak on the S-meter. The PHASING control can then be used to eliminate interfering heterodynes. If the receiver is properly tuned the PHASING control will have no effect on the signal.

Any position of the SELECTIVITY control may be used for CW reception depending on the degree of selectivity required. Position 5 will give the sharpest selectivity with the greatest freedom from interference and lowest background noise level but can only be used on very stable signals. The PHASING control introduces a "notch" (see curve of figure 3-4) which may be moved through the bandwidth of the filter to eliminate interfering signals.

Figure A-1. NC109 with NTS-1 Loud Speaker

SECTION A ACCESSORIES

A.1 NTS-1 LOUDSPEAKER

The National NTS-1 (figure A-1) is an accessory loudspeaker assembly. Style, finish and electrical properties of the NTS-1 make it a perfect match for your NC109.

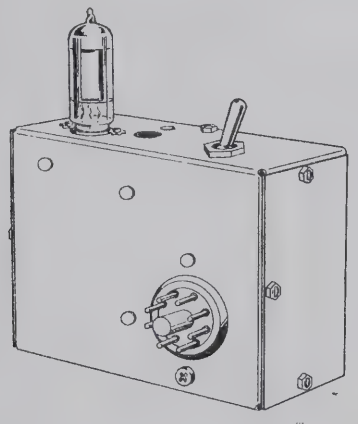

Figure A-2. XCU-109 Crystal Calibrator

A.2 XCU-109 CRYSTAL CALIBRATOR

The National XCU-109 (figure A-2) is a crystal calibrator unit specifically designed for use with the NC109 receiver. An electron-coupled crystal oscillator is used to provide marker frequencies at one megacycle intervals. The oscillator is activated by the toggle switch located on the top of the XCU-109.

A.3 NFM-83-50 ADAPTOR

Your NC109 is adaptable for narrow band FM operation when used with the NFM-83-50 adaptor. (figure A-3) Operating instructions given in paragraph 3.2 of this manual are applicable to NFM operation except that the AM position of the MODE switch is recommended when scanning for FM signals.

An FM signal is recognized by the presence of an audio null in the center of its carrier. Once an FM signal is located, set the MODE switch to its ACC position and tune for maximum response.

NOTE

The pass band of the NFM-83-50 is sufficiently wide to accommodate any narrow band FM signal if the transmitter is held within recommended deviation limits. If excessive peak deviation occurs at the transmitter, distortion will result in the receiver when the adaptor is in use even though the signal appears undistorted when using AM slope detection.

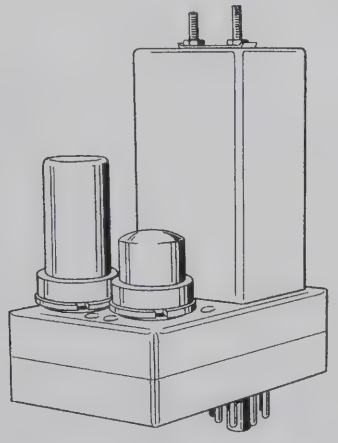

Figure A-3. NFM-83-50 Adaptor

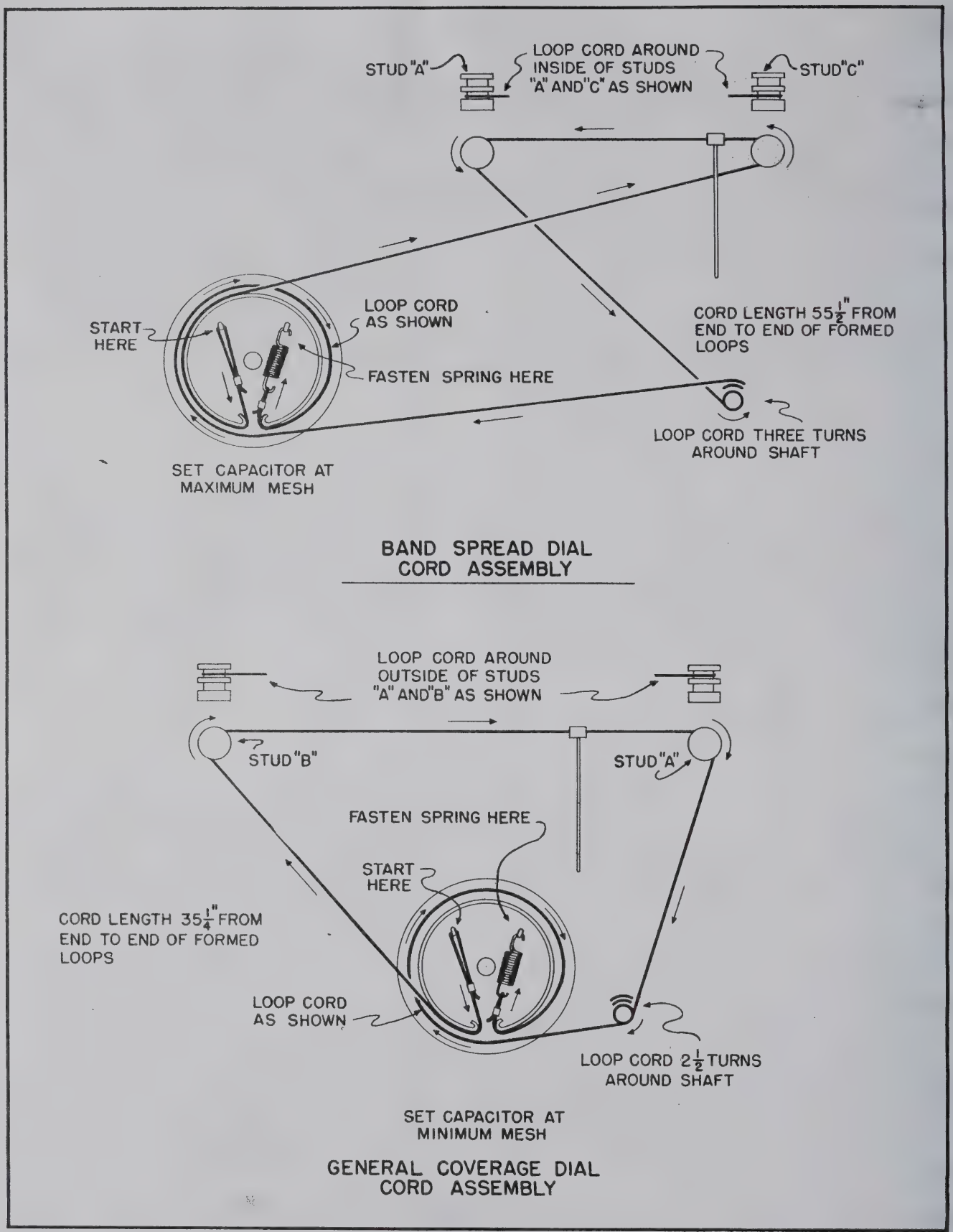
STUD "A"
LOOP CORD AROUND INSIDE OF STUDS "A" AND "C" AS SHOWN
STUD "C"
START HERE
LOOP CORD AS SHOWN
FASTEN SPRING HERE
CORD LENGTH 55 1/2" FROM END TO END OF FORMED LOOPS
LOOP CORD THREE TURNS AROUND SHAFT
SET CAPACITOR AT MAXIMUM MESH
BAND SPREAD DIAL CORD ASSEMBLY
LOOP CORD AROUND OUTSIDE OF STUDS "A" AND "B" AS SHOWN
STUD "B"
STUD "A"
FASTEN SPRING HERE
START HERE
CORD LENGTH 35 1/4" FROM END TO END OF FORMED LOOPS
LOOP CORD AS SHOWN
LOOP CORD 2 1/2 TURNS AROUND SHAFT
SET CAPACITOR AT MINIMUM MESH
GENERAL COVERAGE DIAL CORD ASSEMBLY

Figure 4-1. Dial Stringing Diagrams

Figure A-1. NC109 with NTS-1 Loud Speaker

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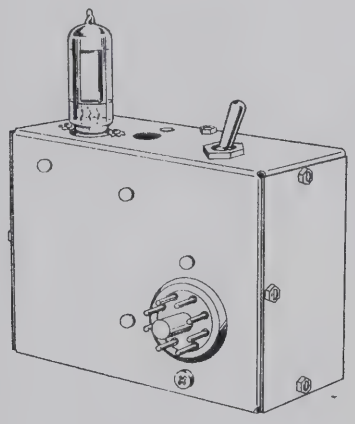

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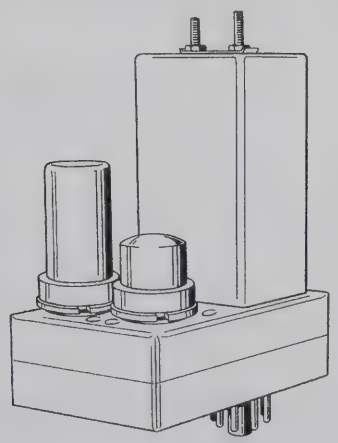
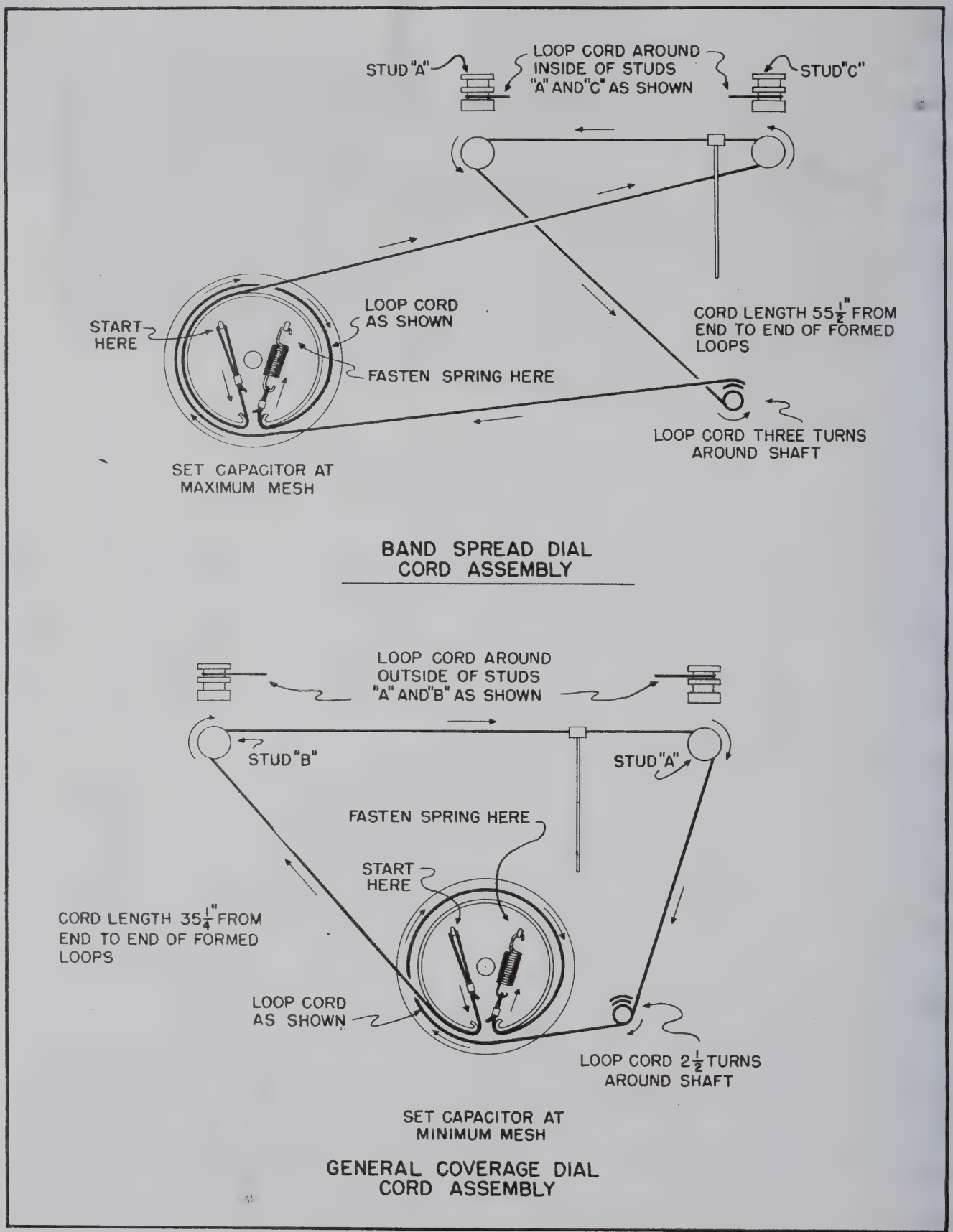


Figure A-3. NFM-83-50 Adaptor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START HERE
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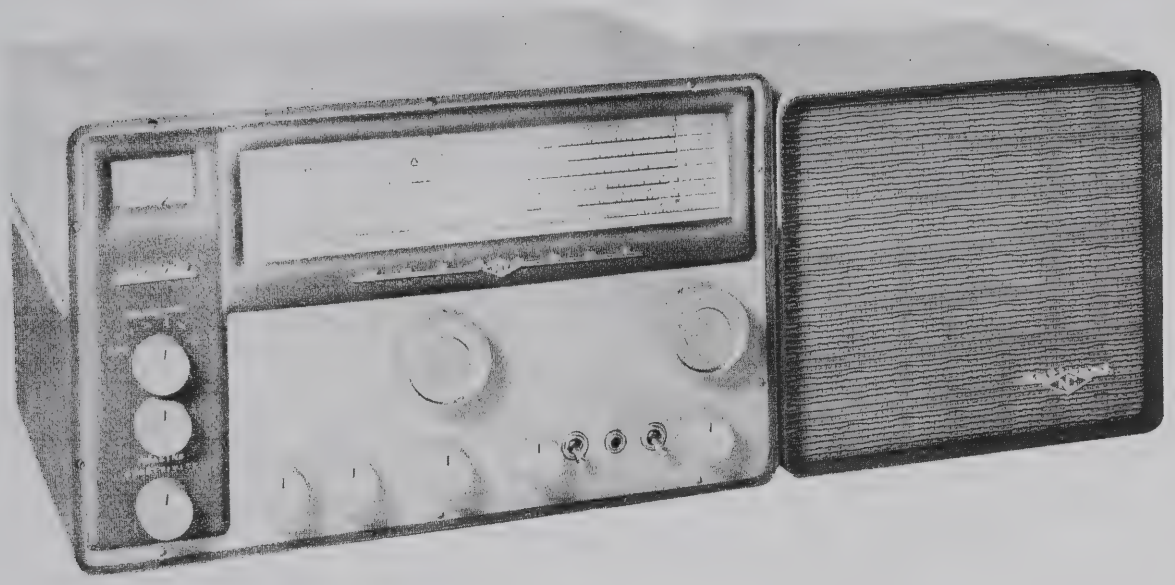
STUD "B"
STUD "A"
FASTEN SPRING HERE
START HERE
CORD LENGTH 35 1/4" FROM END TO END OF FORMED LOOPS
LOOP CORD AS SHOWN
LOOP CORD 2 1/2 TURNS AROUND SHAFT
SET CAPACITOR AT MINIMUM MESH
GENERAL COVERAGE DIAL CORD ASSEMBLY

Figure 4-1. Dial Stringing Diagrams



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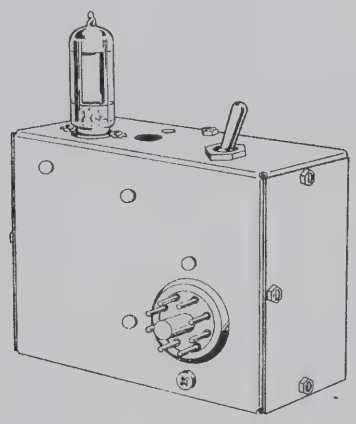

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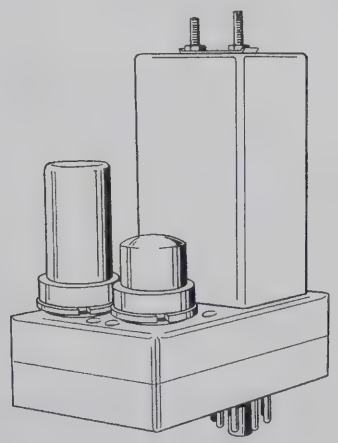

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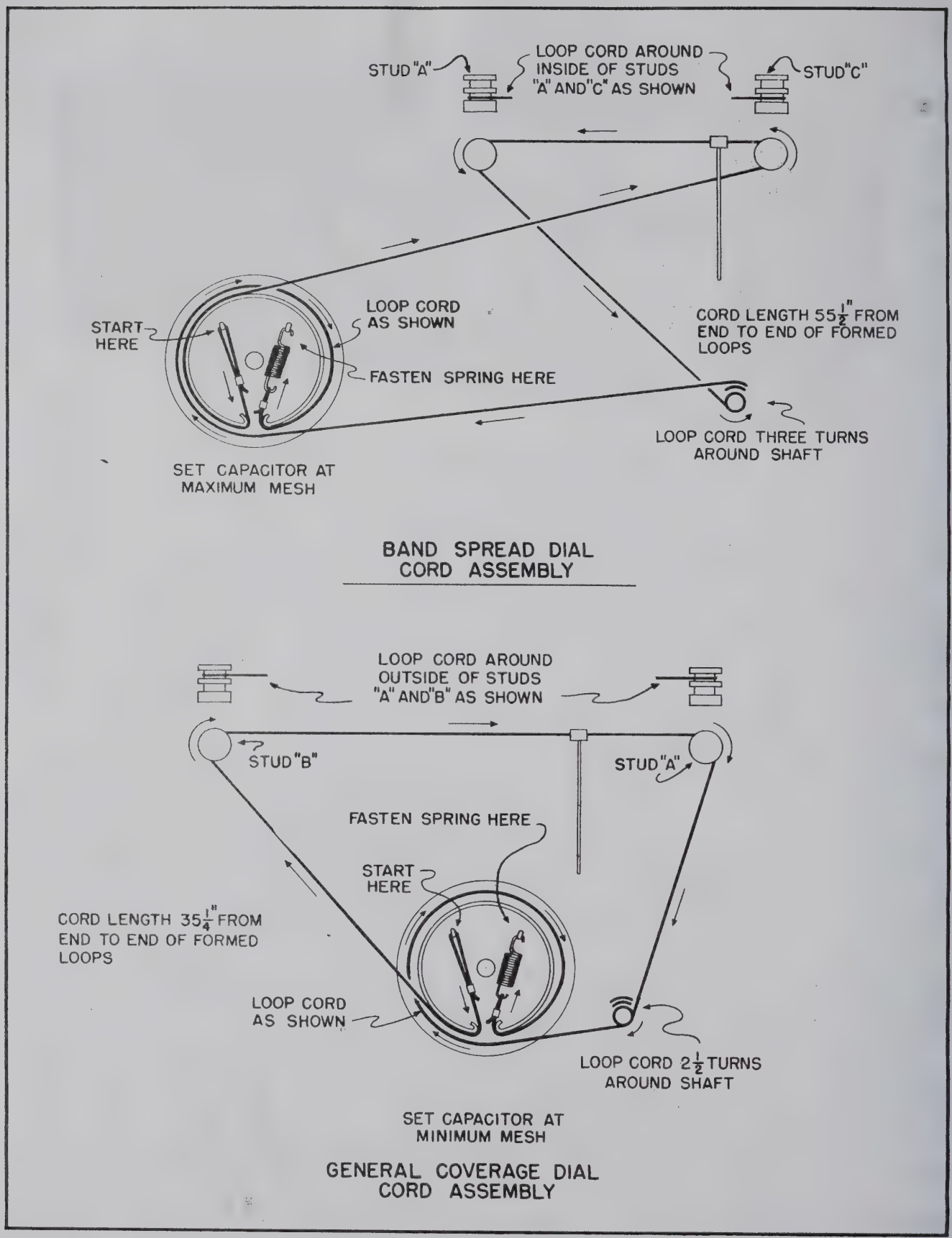
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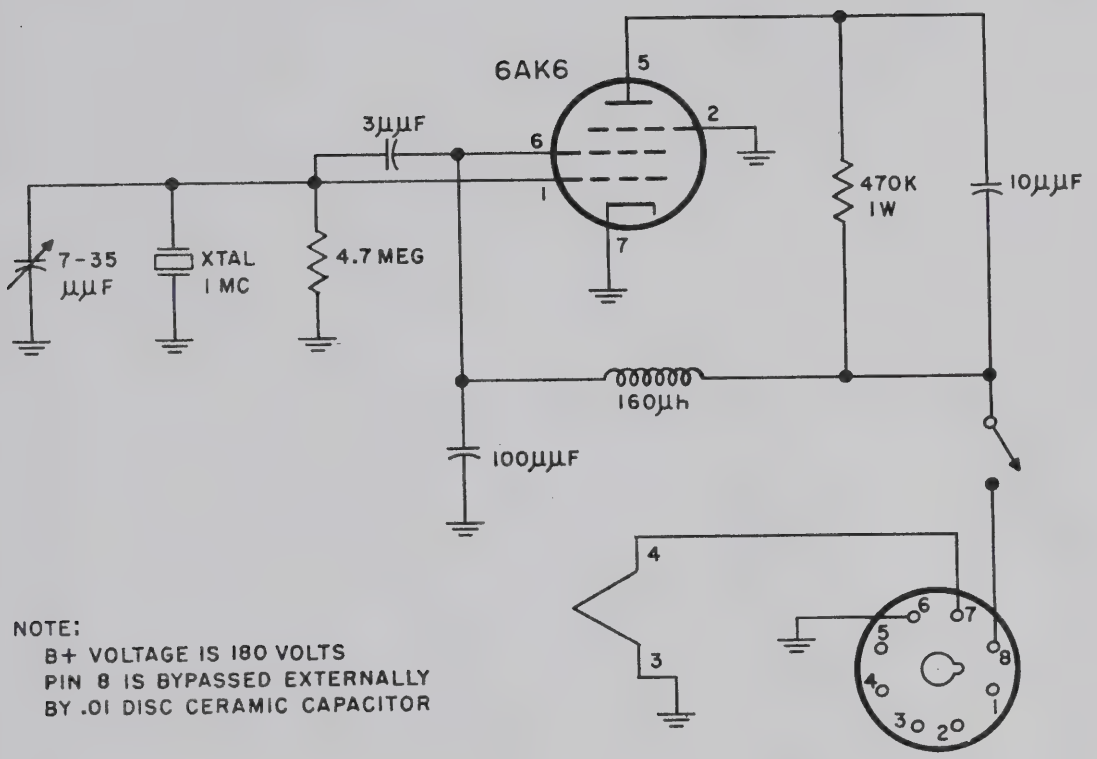
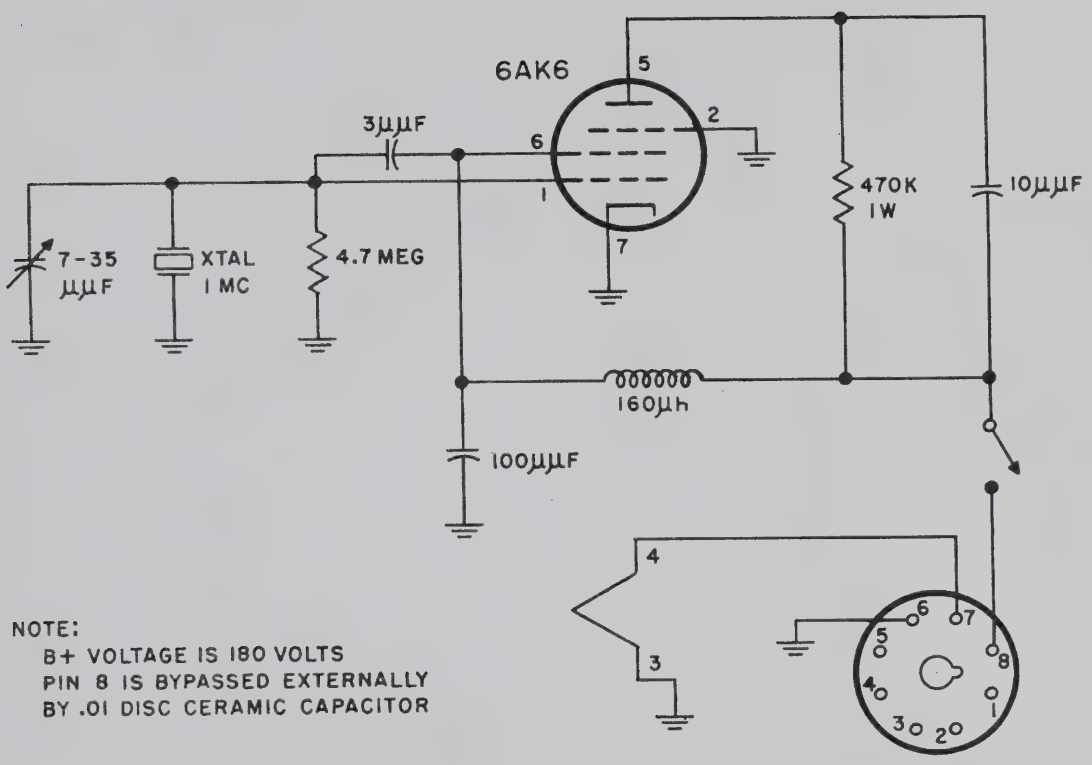


XCU-109 Crystal Calibrator Schematic Diagram



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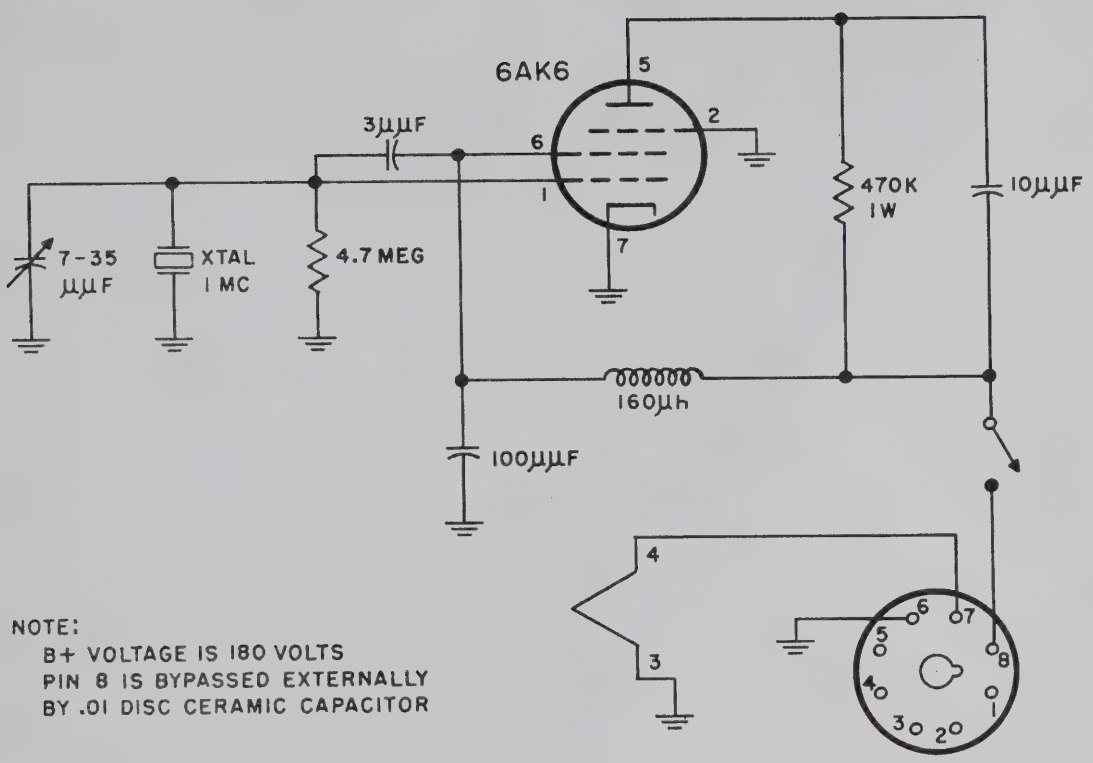

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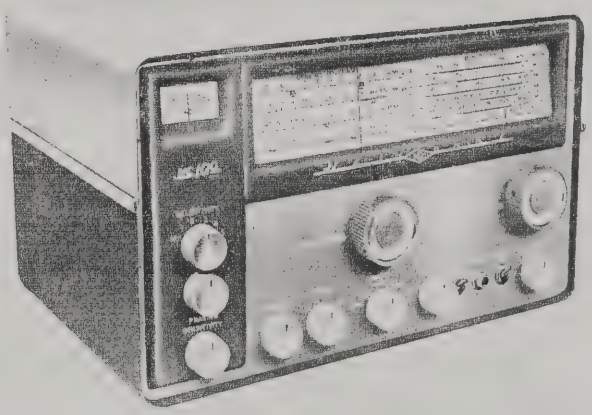
The NATIONAL NC 109 COMMUNICATIONS RECEIVER



STANDARD FORM WARRANTY

ADOPTED BY THE RADIO MANUFACTURERS ASSOCIATION, INC.

This equipment is warranted to be free from defective material and workmanship and repair or replacement will be made of any part which under normal installation, use and service discloses defect, provided the unit is delivered by the owner to the manufacturer or through the authorized radio dealer or wholesaler from whom purchased, intact, for examination, with all transportation charges prepaid to the factory, within ninety days from the date of sale to original purchaser, and provided that such examination, discloses in the manufacturer's judgement that it is thus defective.

This warranty does not extend to any radio products which have been subjected to misuse, neglect, accident, incorrect wiring, improper installation, or to use in violation of instructions furnished by the manufacturer, nor extend to units which have been repaired or altered outside of the factory, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith of other manufacture.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for the manufacturer any other liability in connection with the sale of their radio products.

National Company, Inc. reserves the right to make any change in design or to make addition to, or improvements in, its products without imposing any obligations upon itself to install them in its products previously manufactured.

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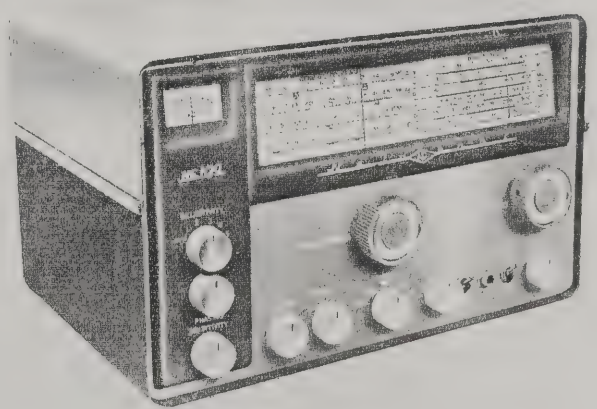

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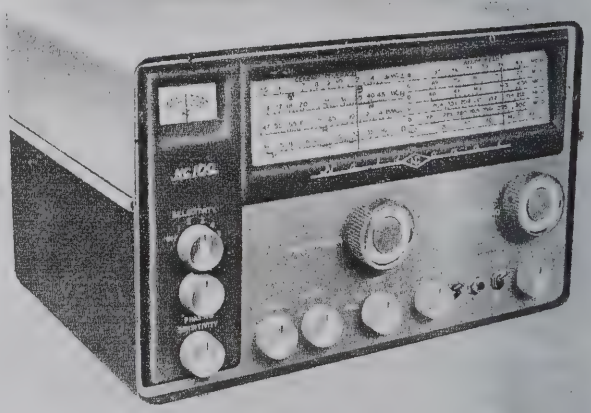

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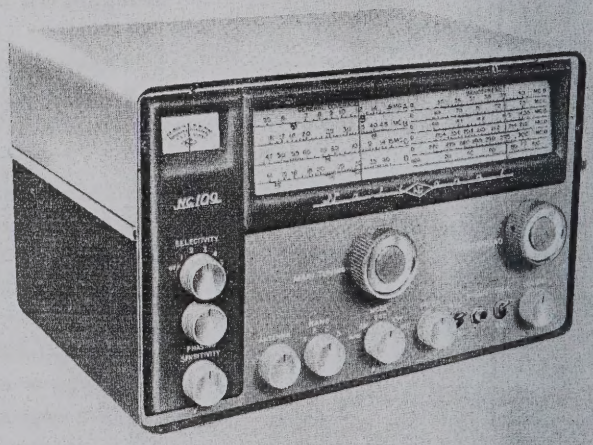

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